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University of Maine

Maine Agricultural Experiment Station

ORONO

BULLETIN 281 OCTOBER, 1919

TRANSMITTING QUALITIES OF JERSEY SIRES FOR MILK YIELD, BUTTER-FAT PERCENTAGE AND BUTTER-FAT.

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BULLETIN 281

STUDIES IN MILK SECRETION

VII. Transmitting Qualities of Jersey Sires for Milk Yield, Butter-Fat Percentage and Butter-Fat.*

Raymond Pearl, John W. Gowen and John Rice Miner

The most important thing which a breeder of dairy cattle desires to know is whether the animals which he breeds are transmitting productive qualities to their offspring. This information is particularly desired for the herd bull since his offspring are much more numerous than those of the cows and he constitutes one-half the heritage given to them. It would appear beyond doubt or question that if a bull's daughters are on the average poorer milkers, or poorer in the quality of their milk, than the dams from which they came, then the bull is exercising a harmful effect upon the breed. On the other hand, if a bull's daughters are on the average measurably better than the dams from which they came, in productive qualities, then that bull is exercising a beneficial effect on the breed. Stated in concrete terms, if D_a represents the milk production of a daughter of a given bull and D_m the milk production of the dam of this daughter; then the measure of this bull's transmitting qualities for milk production of this pair would be

$$\text{Sire's transmitting power} = D_a - D_m$$

If the daughter's production is more than the dam's the sign will be plus. The bull is increasing the production of his daughters and consequently furthering the interests of the breed. If the daughter's production is less than her dam's the sign will be minus. The bull is consequently detrimental to the breed. By the summation of these plus and minus differences with regard to sign, the amount and sign of this summed quantity gives the measure of what he did for all his daughters or averaging this difference gives a measure of what he did for each daughter.

*Papers from the Biological Laboratory, Maine Agricultural Experiment Station, No. 128.

This measure is clearly a measure of what inheritance for milk production this bull transmitted to his daughters when given the average inheritance of their dams upon which to work. Such a measure primarily aims at the germ cells, it is in fact, a measure of the genotype of the bull as distinguished from the phenotype. This measure is further entirely free from any preconceived notions of the mode of inheritance of their milk yield. It is entirely free from personal bias. It simply gives in easily appreciated numerical terms what the bull accomplished, in no way trying to analyze the chain of events which brought about this accomplishment. The measure as applied to the Jersey Registry of Merit Sires (12) is the numerical expression of what the breeder means by potency (5).

Specifically the aims of this investigation will be.

1. To determine the transmitting qualities of Jersey Registry of Merit Sires, for year milk production.

2. To determine the transmitting qualities of Jersey Registry of Merit Sires for butter-fat percentage.

3. To determine the net change in the yearly production of butter-fat between the daughter's production and mother's production for Jersey Registry of Merit Sires.

4. To determine the transmitting qualities of the Sire's sire as judged by the production of the daughters of his son in comparison with that of their dam.

5. Pedigree analysis of the superior and inferior sires of the Jersey Breed.

MATERIAL.

The material used for this study was the records for year test of American Jersey cows contained in volumes I to V of the Jersey Registry of Merit of the American Jersey Cattle Club (12). The rules under which these tests are carried on are given in each volume of the Registry of Merit. These rules call for the supervision of each test by an accredited representative of the agricultural experiment station or college of the state under which the test is made. The rules which govern the action of these supervisors are quite inclusive, meeting practically every contingency which might arise in the conduction of the test. The aim of these rules is, of course, the safeguard-

ing of the accuracy of the records. The precautions taken should make this body of data quite accurate.

Most of these records contain the following information about each cow which has made the Registry of Merit requirements in the test. The Registry of Merit number, name and herd book number of the cow is given. The pedigree record includes the name and number of the sire and dam of the cow tested. The record includes the amount of milk, the percentage of butter-fat, the amount of butter-fat, the age at test, the length of the record and the time at which the record was made.

Methods.

In this investigation was included every bull having two or more daughters with year records in the Registry of Merit volumes I to V when the dams of these daughters also had year records. The reason for not including those bulls with only one daughter was the great variation which such records would take through the influence of chance alone. This variation is seen in table III to be a very considerable quantity when two or more records are considered. It would, of course, be much higher for records based on only one daughter, in fact becoming so great that little or no reliance could be placed in such a record as a measure of the bull's capacities as a breeder.

Laws Governing the Changes in Milk Flow and Butter-Fat Percentage with Age in Jersey Registry of Merit Cattle.

Several papers from this laboratory (7, 11) have dealt with the variation of milk at different ages in the life of the cow. In these studies a correlation of considerable size has been shown between milk production and age at test when this correlation is measured by the correlation ratio. It has been further shown that the regression of milk production on age is by no means a linear regression; in point of fact the regression is logarithmic.

These considerations make it necessary to correct each milk record to a standard age before any just comparison may be made between the milk production of the daughter and that of her dam. For this correction 2153 year records were extracted

from the first two volumes of the Registry of Merit. The mean yearly milk production of each six months age group was determined from these data commencing with the age at test of one year and three months. These mean milk productions are shown in figure 23 as small circles. It will be noted that these observational means are only shown up to the age of twelve years and three months. The data actually had means for the milk productions of each of the six months period up to sixteen years and three months. The mean milk production for these last groups depended on so small a number of individual records that they were very irregular. It was consequently thought best to omit these in the calculations. The irregularity shown for the means of eight years and three months to twelve years and three months is likewise due to lack of numbers in the observations. It has consequently seemed best in the calculations leading up to the fitting of these observational data with a logarithmic function to use the first smooth of these observations, as experience has shown that the smoothed observations approach more nearly the direction that the curve would take if based on a larger series of figures.

The general function which describes the relation of age to amount of milk produced has been shown to be

$$y=a+bx+cx^2+d \log x$$

When the observational means shown in figure 23 are fitted by such a curve, the theoretical curve shown in the figure 23 is obtained. The equation to this curve is

$$y=4586.50+307.55x-12.65x^2+2216.62 \log x$$

A comparison of the observational means and the theoretical means are all that is required to show the close similarity of the two curves. It does not seem necessary therefore to calculate the χ^2 value for this curve.

The law which governs the relation of age and milk production for these Registry of Merit Jersey cows may be expressed in words as follows. In these Jersey cows the absolute amount of milk produced per unit of time increases with the age of the cow until a maximum is reached, but the amount of increase diminishes each year with advancing age until the ab-

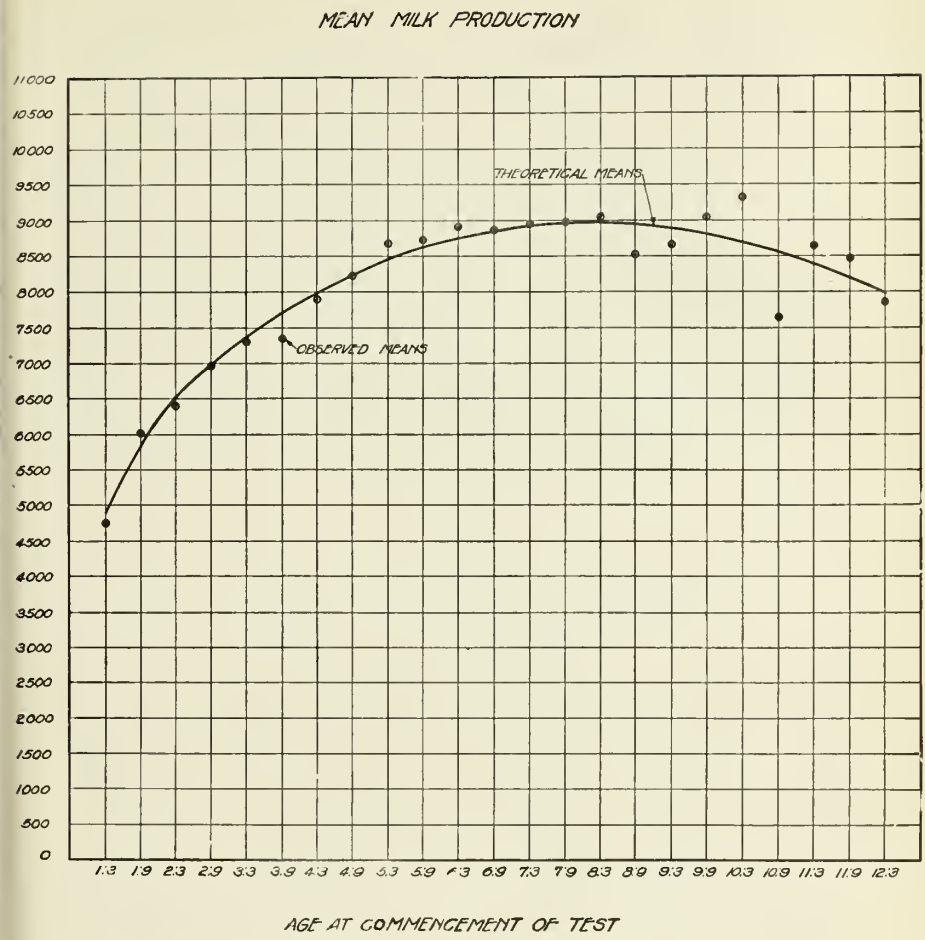


FIGURE 23. Observational and Theoretical Curves of mean milk production (365 day) at various ages in Jersey Cows.

solute maximum production is reached. After the time of maximum productivity the absolute production per unit of time decreases with advancing age, and by a continually increasing amount. This is essentially the same law that has been found to govern the Ayrshire (10), the Jersey seven day (11), and eight month records (3), the Holstein-Friesian 7 day and year records (2, 3, 4) and the Guernsey year records (, 3).

METHOD OF CORRECTING RECORDS OF MILK PRODUCTION AND BUTTER-FAT PERCENTAGE AT ANY AGE TO THE EXPECTED RECORD AT STANDARD AGE.

A knowledge of the function which describes this law allows us to calculate what correction should be applied for this mean change in the milk production. The choice of the place to which this correction was to be made was chosen as the maximum production at eight years. The actual maximum mean milk yield comes at 8.12 years as determined by differentiation of the curve given above. These correction factors were determined for each three months of age. All the records used in this study have been corrected to their expected production at this constant age of 8 years. The manner in which this correction was made may be stated mathematically as a simple proportion.

Corrected milk at standard age : observed milk at *a* years :: Mean milk at standard age : mean milk at *a* years.

For the animals which have more than one Registry of Merit test, the test which was made nearest eight years of age was used.

The same general method was used in the correction of the butter-fat percentage records. The theoretical function which describes the relation of age and butter-fat percentage was determined. From this theoretical function, which is a linear one with a slight but consistant decline in the mean butter-fat percentage with age, were determined what corrections should be applied to the butter-fat percentage to bring all the records to a constant age basis. The manner in which this correction was used is similar to the proportion shown above for the correction of milk production. The standard age for the butter-fat percentage was taken at two years as this is the age nearest the maximum butter-fat percentage of the cow.

The butter-fat expected of the cow for these standard ages was determined by multiplying the amount of expected milk by the expected butter-fat percentage.

All records used for the determination of the transmitting qualities for Jersey sires were based on these expected records at the standard ages. All records referred to in this paper from

this point on will be understood to be for this expected record at the standard age unless specifically mentioned to the contrary. Thus the measure of the bull's transmitting ability (= daughter's milk production—dam's milk production) considers only the expected milk productions.

VARIATION OF CORRECTED REGISTRY OF MERIT RECORDS.

In all such investigations as the one in which we are engaged it is desirable to know what error is likely to be involved through the variation of milk production or butter-fat percentage due to chance. For the determination of this error the frequency distribution of the expected milk production and butter-fat percentage are necessary. These distributions are given in table I and graphically shown in figure 24 and 25.

TABLE 1.

Frequency distributions of expected milk production and butter-fat percentage of Jersey Registry of Merit cows, mothers and daughters.

Milk Production	Frequency		Butter-Fat Percentage	Frequency	
	Daughter	Dam		Daughter	Dam
5499.5— 6499.5	6	1	4.0995—4.2995	5	1
6499.5— 7499.5	71	48	4.2995—4.4995	10	2
7499.5— 8499.5	181	153	4.4995—4.6995	31	18
8499.5— 9499.5	214	190	4.6995—4.8995	47	30
9499.5—10499.5	176	142	4.8995—5.0995	71	50
10499.5—11499.5	149	93	5.0995—5.2995	122	83
11499.5—12499.5	97	53	5.2995—5.4995	147	105
12499.5—13499.5	57	38	5.4995—5.6995	135	120
13499.5—14499.5	30	18	5.6995—5.8995	156	110
			5.8995—6.0995	125	91
14499.5—15499.5	19	7	6.0995—6.2995	101	74
			6.2995—6.4995	61	53
15499.5—16499.5	10	4	6.4995—6.6995	34	37
			6.6995—6.8995	20	16
16499.5—17499.5	4	9	6.8995—7.0995	13	13
17499.5—18499.5	2	2	7.0995—7.2995	2	2
18499.5—19499.5	1	2	7.2995—7.4995		1
19499.5—20499.5	2	1	7.4995—7.6995	1	1
20499.5—21499.5		1			
Total	1019	762		1081	810

The Constants derived from Table I are shown in Table 2.

TABLE 2.

Physical Constants for the Expected Milk and Butter-Fat Percentage of Jersey Registry of Merit cows, mothers and daughters.

Character	Mean	Standard Deviation	Coefficient of Variation	Quartile Limits		
				First	Median	Third
Daughter's Milk Production	9547.6±44.7	2114.4±31.6	22.15±.35	7982±61	9213±56	10780±.61
Dam's Milk Production	9391.9±51.5	2107.3±36.4	22.44±.41	7931±70	8942±65	10403±70
Daughter's Butter-Fat Per cent	5.558±.011	0.5508±.0080	9.91±.15	5.174±.015	5.559±.014	5.938±.015
Dam's Butter-Fat Per cent	5.625±.013	0.5546±.0093	9.86±.17	5.235±.018	5.593±.016	5.995±.018

From table 2 it is possible to determine if on the average the daughters of Jersey Registry of Merit cows are better than their dams. The difference between the mean milk production of the daughters from that of their dams is 155.7±68.2, a difference which is certainly not significant. The difference between the mean butter-fat percentage of the daughters and their dams is —0.067±.017 or the difference is 3.9 times the probable error. These facts lead to the conclusions that the mean milk production of the daughters of Registry of Merit cows does not differ from that of their dams and that to a small degree these same daughters are slightly lower in butter-fat percentage than are the dams from which they came.

The standard deviations for these tables give the necessary information to determine the probable error of the mean gains or losses of any number of pairs of daughters and their dams. It has seemed best to base these calculations on the standard deviations of the general population rather than on the standard deviations of the individual sires as it is believed the probable error obtained will be more nearly its true value. The calculation of this probable error of the mean gains or losses is done by the usual probable error of the difference formula, when the standard deviation of the difference is equal to

$$\sqrt{\sigma_1^2 + \sigma_2^2 - 2 r_{12} \sigma_1 \sigma_2} \quad (4)$$

Where σ_1 is the standard deviation of the daughter's correlated milk production, or butter-fat percentage and σ_2 the standard deviation of the dam's milk production or butter-fat percentage as the case may be. The calculation of the probable error in the net change of the butter-fat can be easily made from the above formula after the standard deviation of the net butter-fat of the daughters and the standard deviation of the net butter-fat of the dams are known. The formula for these constants is approximately

$$M_1 M_2 \sqrt{v_1^2 + v_2^2 + 2r_{12} v_1 v_2} \quad (4)$$

Where M_1 equals the mean milk production, M_2 equals the mean butter fat percentage, v_1 the coefficient of variation of the milk production and v_2 the coefficient of variation of the butter-fat percentage.

Table 3 gives the probable errors derived by the above formula.

This table shows that little reliance can be placed in the mean gain or loss in the milk production if the figures are based on only two daughters and their dams, for the error due to chance is likely to be 1154.5 pounds or to be significant the difference of such pairs would have to be 3463.5, a difference only rarely found. The error on as many as forty such pairs is not very great (258.2 pounds). The probable error for the butter-fat percentage on two pairs is so large that only differences over 1.059 can be considered as more than indicative of a superior bull. For the bull that has as many as forty pairs much smaller differences are required. The probable errors for the number of pairs for the butter-fat are likewise large for those sires which have only two pairs and relatively much smaller for the sires with as many as forty pairs.

In the balancing up of the true worth of a bull it is essential that these facts be taken into consideration in weighing the evidence as to his merit.

TABLE 3.

Jersey Year Records. Probable Errors of Differences Between Mean Performances of Mothers and Daughters.

N	Milk	Fat %	Net Fat
2	1154.5 lbs.	0.353 %	58.21
3	942.6 lbs.	0.288 %	47.53
4	816.3 lbs.	0.249 %	41.16
5	730.1 lbs.	0.223 %	36.82
6	666.5 lbs.	0.204 %	33.61
7	617.1 lbs.	0.189 %	31.11
8	577.2 lbs.	0.176 %	29.11
9	544.2 lbs.	0.166 %	27.44
10	516.3 lbs.	0.158 %	26.03
11	492.3 lbs.	0.150 %	24.82
12	471.3 lbs.	0.144 %	23.76
13	452.8 lbs.	0.138 %	22.83
14	436.3 lbs.	0.133 %	22.00
15	421.5 lbs.	0.129 %	21.26
16	408.2 lbs.	0.125 %	20.58
17	396.0 lbs.	0.121 %	19.97
18	384.8 lbs.	0.118 %	19.40
19	374.6 lbs.	0.114 %	18.89
20	365.1 lbs.	0.112 %	18.41
21	356.3 lbs.	0.109 %	17.96
22	348.1 lbs.	0.106 %	17.55
23	340.4 lbs.	0.104 %	17.17
24	333.3 lbs.	0.102 %	16.80
25	326.5 lbs.	0.100 %	16.46
26	320.2 lbs.	0.098 %	16.14
27	314.2 lbs.	0.096 %	15.84
28	308.5 lbs.	0.094 %	15.56
29	303.2 lbs.	0.093 %	15.29
30	298.1 lbs.	0.091 %	15.03
31	293.2 lbs.	0.090 %	14.79
32	288.6 lbs.	0.088 %	14.55
33	284.2 lbs.	0.087 %	14.33
34	280.0 lbs.	0.086 %	14.12
35	276.0 lbs.	0.084 %	13.92
36	272.1 lbs.	0.083 %	13.72
37	268.4 lbs.	0.082 %	13.53
38	264.9 lbs.	0.081 %	13.35
39	261.4 lbs.	0.080 %	13.18
40	258.2 lbs.	0.079 %	13.02

CHANGE IN THE RELATIVE MILK PRODUCTION OR BUTTER-FAT PERCENTAGE OF A BULL'S DAUGHTERS OVER THAT OF THEIR DAMS.

Table 2 in conjunction with table 1 furnishes information of a good deal of value in distingushing bulls of superior worth as measured by what their progeny do in producing milk or butter-fat. It is altogether probable that a bull in a herd composed of cows like Sophie's Agnes or Vive la France would find it harder to raise the production of these cow's offspring than would the same bull going into a herd composed of 4000 pound cows. Now a table to measure the sire's transmitting qualities by his progeny performance similar to the one con-

templated in this paper does not allow for this difference in herds. It is necessary, therefore, to have some means of recognizing this difference in the cows to which these bulls are bred. This is easily accomplished by dividing the frequency areas of table 1 into four equal parts or quartiles. The distribution for these quartiles given in table 1. The place of division for each quartile is given in table 2 for the daughter's milk and butter-fat percentage and for the dam's milk and butter-fat percentage. Figures 24 and 25 give the histograms and the quartiles for the mother's and the daughter's milk and for the mother's and the daughter's butter-fat percentage.

The quartiles may be designated as follows, *A* the amount of milk or butter-fat percentage above the third quartile line; *B* the amount of milk or butter-fat percentage between the median and the third quartile line; *C* the amount of milk or the butter-fat percentage between the first quartile line and the median; *D* the amount of milk or butter-fat percentage below the first quartile line. In this way the change in the milk production or butter-fat percentage between any dam and her daughter may be expressed by two letters. For instance a record of the relative milk production *AC* means that the dam's milk production is over 10403 pounds and the daughter's milk production between 7931 and 8942 pounds. A butter-fat percentage record *DB* means that the mother's butter-fat percentage is below 5.235 per cent and the daughter's butter-fat percentage between 5.593 per cent and 5.995 per cent. In recording a bull with two or more daughters it seems best to put these pairs on the basis of one hundred. Thus a bull with two tested daughters out of tested dams, and one dam is in respect to milk production in class *A*, her daughter in class *B*, and the pair recorded as *AB;* the other dam in class *C* and her daughter in class *A* and the pair recorded in *CA;* the record for the bull will then be 50 AB + 50 CA and the number of pairs on which this record is based will be two. The extension of this method allows the recording of any number of pairs. In this manner it is possible to always know how many daughters a bull's record is based on and where in the general population of daughters these daughters' records lie in comparison with the place in the general population occupied by the records of their dams.

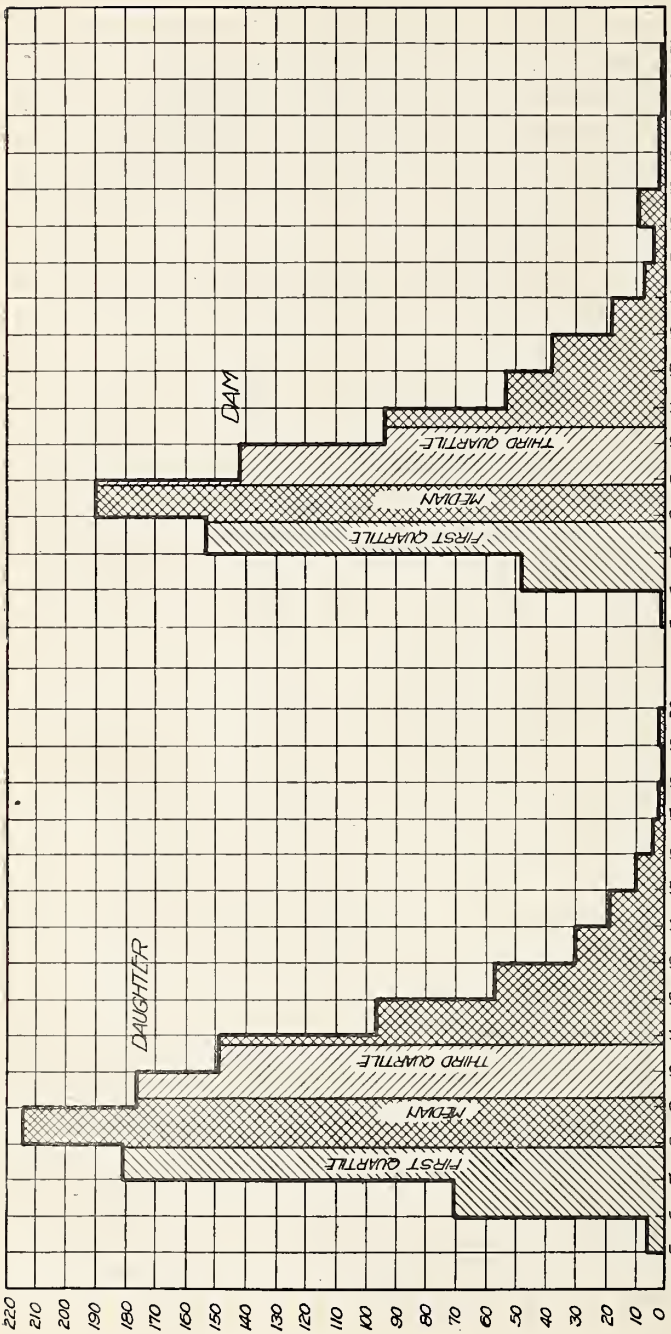


FIGURE 24. Histograms showing the frequency distributions of corrected milk Production for Jersey Registry of Merit daughters and their dams' (365 day) record. The quartile lines divide these distributions into the four equal areas which are used to denote the relative place for the yield of the cow in the breed.

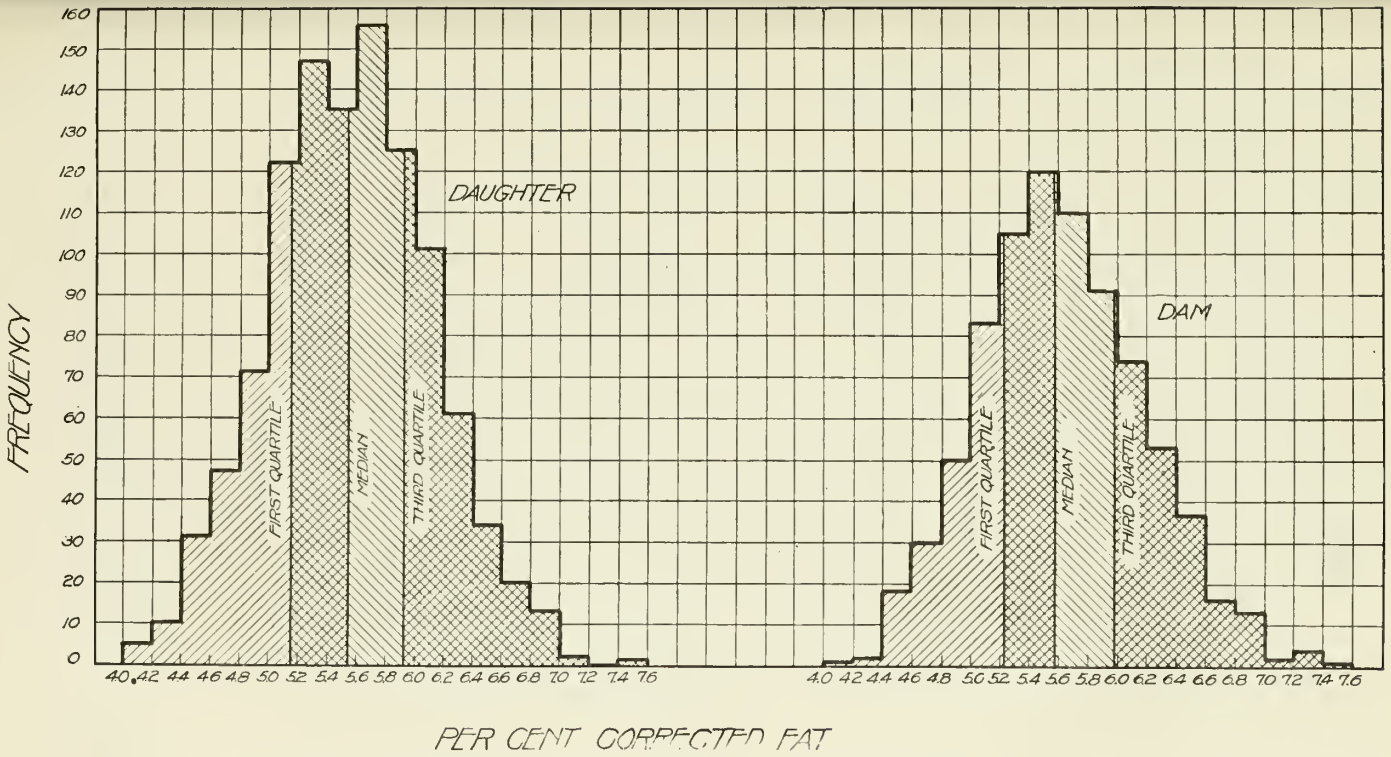


FIGURE 25. Histograms showing the frequency distribution of corrected Butter-Fat percentage for Jersey Registry of Merit, daughters and their dams. (365 day record.) The quartile lines divide these distributions into the four equal areas which are used to denote the relative place for the yield of the cow in the breed.

METHOD OF DISTINGUISHING SUPERIOR AND INFERIOR SIRES.

The bull of superior merit seems unquestionably the animal whose progeny are more productive in milk, butter-fat percentage and butter-fat than the dams from which they came. This has therefore been the criterion used to distinguish the superior and inferior sires of the Jersey breed. In the first lot are included all bulls which have their daughters more productive in both milk and butter-fat percentage than their dams. In the second group are placed those bulls whose daughters were inferior in both of these particulars to their dams. Since in all probability the first set were a great boon to the breed and the second set a distinct drawback to the breed's progress it seems of objective value to study these two groups especially carefully in the hope of throwing some light on the reasons for this difference. For this purpose pedigrees of all the animals in these two groups were made and subjected to analysis.

PEDIGREE METHODS.

The factors determined for these pedigrees are, the amount of inbreeding that has taken place, the degree or amount of relationship which exists between the parents of the sire under consideration and the absolute and percentage of American and island ancestry contained in the pedigree of these bulls.

The methods used have been amply discussed in a series of papers from this laboratory (6, 8, 9) and need only be briefly discussed here.

Inbreeding in these studies is defined as the condition or state in which an organism has in fact fewer different ancestors than the maximum number possible.

The degree or amount of inbreeding (total) is measured by a series of inbreeding coefficients, one for each ancestral generation, defined by the following equation:

$$Z_n = \frac{100\ (P_{n+1} - q_{n+1})}{P_{n+1}}$$

where P_{n+1} denotes the maximum possible number of different individuals involved in the matings of the $n+1$ generation,

q_{n+1} the actual number of different individuals involved in these matings, and Z_n is the inbreeding coefficient for the n+1 the ancestral generation.

The amount of inbreeding may be expressed as a single numerical quantity by referring the inbreeding as expressed for each generation to the maximum possible inbreeding of a brother and sister mating. The formula by which this single measure of inbreeding is determined is

$$Z_{T_n} = \frac{100 \sum \frac{Z_n}{Z_1}}{F_{T_n}}$$

where Σ denotes summation of all values between the inclusive limits indicated, F_{T_n} is the total area of the maximum brother x sister curve up to and including the n+1th generation. Z_{T_n} is the measure of the inbreeding.

A state or condition of relationship or kinship between two organisms exists when these organisms have one or more common ancestors. The degree, intensity or closeness of the relationship is, in general, proportional to the number of different ancestors which the two individuals have in common, out of the whole number they might possibly have in common.

The degree or amount of relationship, in accordance with the above definition, is numerically measured by relationship coefficients, one for each ancestral generation. The coefficients are calculated in two slightly different ways according to whether they are being evaluated in connection with inbreeding coefficients, which will usually be the case, or independently.

When calculated in connection with inbreeding coefficients, a relationship coefficient is calculated in accordance with the following equation:

$$\frac{Kn}{100} = \frac{(pn+1 - qn+1) - (sZn-1 \; sPn + dZn-1 \; dPn)}{\frac{1}{2} Pn+1}$$

where the letters have the same significance as in the above equation with the additions that K denotes a relationship coefficient, a prefixed subscript s means that letters following it refer to the pedigree of the sire only, and a prefixed subscript

d means that the letters following refer to the pedigree of the dam only.

The analysis of the amount of American and Island ancestry is approached in these ways. Only the Island animals are tabled as the number of the American animals of any desired group may be obtained by difference.

(1) The number of Island bulls and Island cows found in the pedigree of the superior and of the inferior sires are tabled separately, and recorded in absolute numbers and in percentage of the total ancestors.

(2) The absolute number and percentage of island bred animals occurring in the sire's or dam's side of the pedigree are recorded.

Besides this information a table is given to show what proportion the Island ancestors are of the total great-great-grandparents of the superior and inferior sires. This information is classified in the two ways indicated above.

From these facts the relative influence of the island imported stock can in some degree be determined for the superior and inferior sires of the Jersey Registry of Merit.

THE TRANSMITTING QUALITIES OF JERSEY SIRES FOR MILK PRODUCTION.

In table 4 is given all Registry of Merit Bulls with two or more tested daughters coming from tested dams. These bulls are arranged according to the number of pounds of milk that their daughter's yearly production was greater than their dam's yearly production. This information is given in the fifth column of the table. These bulls are given a number (shown in the first column) running from the bull producing the greatest average net increase in his daughter's milk production, Queen's Raleigh, to the bull producing the greatest average net decrease in his daughter's milk production, Hood Farm S. Tormentor. In the second column is given the bull's name. In the third column is given the registry number. The fourth column contains the number of daughter-dam pairs on which the average net change of milk production is based. The last column marks the quartile changes, records the relative position of the

milk production of the dam and daughter. The dam's milk production is recorded first as A the highest production, B the next highest group, C the next to the lowest milk production group and D the lowest milk production group. The daughter's milk production is recorded after the dam's, the letters having the same significance. The distribution and limits for these groups are shown in table 1, figure 24. The coefficient in front of the letters gives the numbers in each group on the basis of 100 for the total.

Thus, the record for Queen's Raleigh (67 B A + 33 D A) shows that all the recorded daughters of his get were in the A class; 67 per cent or two-thirds of them were out of B class dams and 33 per cent or one-third were out of D class dams. The coefficients therefore represent the percentages of the different kinds of daughters which a given bull got from different classes of dams.

The information on the transmitting qualities of Jersey sires for milk production above described is given in table 4.

TABLE 4.

Bulls in Order of Net Change in Milk of Daughters.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change Lbs.	Quartile Changes
1	Queen's Raleigh	88232	3	+4545.7	67BA+33DA
2	Sans Aloi	81012	2	+4464.5	100DA
3	Temisia's Interested Prince	71648	2	+3686.5	50DA+50DB
4	Rinda Lad of S. B.	89518	2	+3403.5	50DA+50DB
5	Golden Nero	62052	2	+3369.0	50DA+50DB
6	Agatha's Brookhill Fox	69633	2	+2957.5	50BA+50DB
7	Signal's Successor	72758	3	+2899.3	33AA+33DA+33DB
8	The Plymouth Lad	89792	4	+2810.3	25CA+25CC+50DA
9	You'll Do Oxford	98772	2	+2797.0	50CA+50DA
10	Hood Farm Figgis Torono	90517	3	+2706.3	33BA+33CB+33DA
11	Fontaine's King	65641	2	+2678.5	50BA+50CA
12	Hood Farm Torono	60326	34	+2620.1	26AA+3AB+9BA+3BB+3BO+32CA+9CB+9DA+3DB+3DC
13	Roma's Rioter of St. L.	70951	3	+2534.7	33BA+33BC+33CA
14	Hood Farm Pogis 34th	65309	2	+2528.0	50DA+50DD
15	Eminent's Pilot	75364	3	+2380.0	33BA+33DA+33DC
16	Channel King	62762	2	+2332.0	50CA+50CD
17	Tormentor's Landseer Signal	69291	4	+2326.7	25BA+50CB+25CD
18	Chief Engineer	47148	6	+2174.5	17AA+33BA+33CA+17CC
19	Golden Glow's Chief	61469	4	+2172.4	75BA+25CB
20	Majestic Fern	84428	3	+2163.3	33BA+33BB+33DC
21	Royal Majesty	79313	5	+2138.6	40AA+20BA+20BB+20CA
22	Forfarshire's King Dalton	95339	7	+2064.6	14AA+14AD+14CA+14CC+29DA+14DD
23	The Owl's Double Grandson	80314	5	+2015.2	60AA+20AB+20BA

Bulls in Order of Net Change in Milk of Daughters. —Continued.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change Lbs.	Quartile Changes
24	Rearguard	70962	2	+1992.5	50AA+50AC
25	Baronetti's Golden Lad	67908	2	+1924.5	50BA+50DC
26	Oxford's Fairy Boy	92821	3	+1772.0	33CA+33CB+33DC
27	Lady Letty 4th's Rioter	76533	2	+1767.0	50CA+50CC
28	Marston's Interested Prince	71855	9	+1764.8	11AB+11BA+11BC+22CA+11CC+22DA+11DB
29	Melia Ann's King 9th	74917	2	+1734.5	50CB+50DC
30	Taurus Perfection	80132	2	+1705.5	50BB+50DB
31	Spermfield Owl	57088	26	+1695.7	12AA+4AB+4AC+23BA+12BB 4BC+8CA+8CB+4CD+12DA +4DB+8DD
32	Gertie's Stoke Pogis	56492	3	+1688.3	67AA+33DA
33	Eminent's Tormentor	85936	2	+1662.5	50CB+50DC
34	Spermfield Owl 2d	93634	2	+1653.5	50CB+50DB
35	My Jubilee	75742	2	+1646.5	50AA+50BA
36	Jenny's Redfern	70388	2	+1582.0	50CB+50DB
37	Eva's Grey Fox	72444	2	+1564.0	50BC+50CA
38	Eminent of Acca Farm	84617	3	+1518.4	33AB+33BA+33BB
39	The Warden's Sir Prince	89421	2	+1498.5	50CA+50CD
40	Rioter's Jersey Lad	58001	7	+1415.2	14BB+14CA+14CB+14CD+14DA+14DB+14DD
41	Oxford Lass's Cream King	81359	3	+1386.0	100CC
42	Hood Farm Golden Lad	64268	5	+1357.2	20BC+40CA+20CB+20DC
43	Golden Lad of Glenwood Farm	62057	3	+1328.4	33BA+33BC+33CA
44	Eminent's Raleigh	69011	2	+1325.0	50BC+50CA
45	Tormentor Summit Lad	68620	4	+1244.3	25CA+25CD+25DB+25DD
46	Chenille's Golden Prince	91769	2	+1242.0	50AA+50CC
47	Golden Lad of Summit	85396	6	+1218.2	17AB+17BB+50CB+17DA
48	Melia Ann's Hero 4th	84061	3	+1208.3	33CD+33DB+33DC
49	The Warden	77015	12	+1189.6	17CC+8DB+50DC+25DD
50	Eurybia's Blue Boy	90591	3	+1170.3	33BA+33CA+33CD
51	Golden Fern's Son	78687	9	+1156.5	11AA+11BA+11CA+22CB+22CC+11DA+11DC
52	Foxhall's Jubilee	76944	10	+1109.1	10AA+30AB+10BA+10BB+10CA+20DA+10DD
53	Anderson's King	75247	2	+1105.0	50BD+50DA
54	Sultan of Oaklands	78475	3	+1104.7	33CC+33DA+33DD
55	Fairfield's Chancellor	74363	2	+1083.0	50BB+50DC
56	Mabel's Raleigh	P.S. 3722 H.C.	3	+1078.0	67BA+33BB
57	Copper Baron	64453	2	+1065.5	50CB+50DC
58	Lord Letta of Meridale	55716	2	+1065.0	100BA
59	Dorinda Darling's Diploma	71816	6	+1042.9	17AA+17AB+17BA+17CB+17CD+17DB
60	Oxford King of Fernwood	81379	3	+1039.3	33BC+33CA+33DB
61	Loretta's King	65050	18	+1000.2	6AC+6AD+11BA+11BB+6CA+11CB+6CD+6DA+17DB+22DC
62	Pogis 99th of Hood Farm	94502	14	+ 995.2	36AA+7AB+7AC+14CA+14CB+21DA
63	Brown Bessie's Columbus	68364	3	+ 992.3	33CB+67CC
64	Hood Farm Golden Lad 4th	71215	3	+ 939.6	33BA+33BB+33CA
65	Mr. Inez Marigold Pedro	79701	3	+ 925.0	100DC
66	Golden Shylock	81862	5	+ 871.8	20AB+20BC+20CA+20CC+20DA
67	Nimbus of Brondale	69704	3	+ 775.3	33DC+67DD
68	St. Lambert's Ridgewood King	73247	2	+ 670.0	50BC+50DB
69	Bessie Bate's Lad	78296	2	+ 649.5	100AA
70	G. G. Chief of Ashburn	86044	3	+ 591.7	33BB+33BD+33DB
71	Pogis 66th of Hood Farm	85015	3	+ 514.7	33AA+33BA+33CA
72	Naiad's Golden Lad	67475	3	+ 508.0	33BB+33BC+33CB
73	Hazel Fern Golden King	77872	8	+ 494.4	37BB+13CB+13CC+25DB+13DD

Bulls in Order of Net Change in Milk of Daughters. —Continued.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change Lbs.	Quartile Changes
74	Raleigh's Fairy Boy	83767	10	+ 453.8	40AA+10AB+10BA+30BB+10CA
75	Imp. Nobel Fontaine Raleigh	91142	5	+ 450 0	20BB+20CD+20DB+20DC+20DD
76	Hood Farm Pogis 9th	55552	39	+ 448.9	5AA+5AB+3AC+5AD+10BA+8BB+8BC+3BD+18CA+8CB+8CC+8CD+3DB+3DC+8DD
77	Willson's Exile	44065	2	+ 447.0	50CB+50CC
78	Romulus of Spring Hill	78837	4	+ 442.2	25BC+25CA+25CB+25CC
79	Rochette's Noble	96422	2	+ 440.0	50BB+50DC
80	Blue Belle's Gold Fern	79043	3	+ 429.4	33AA+33BA+33BC
81	Interested Prince	58224	21	+ 401.8	14AA+5AB+10AC+19BA+5BC+5BD+10CA+5CB+5CD+10DA+5DB+10DD
82	Oxford John D.	90048	3	+ 377.7	67AA+33BB
83	Flying Fox's Oxford Duke 2d	76316	2	+ 372.5	50CB+50CC
84	Lad's Oxfordshire	74564	2	+ 339.5	50AB+50CA
85	Karnak's Noble	87952	4	+ 338.8	50AA+25BA+25BB
86	Lookout Torono	78593	17	+ 324.7	24CD+6DB+24DC+47DD
87	Nebraska Lad	71828	2	+ 296.5	50BA+50CC
88	Clear Brook Chief	74685	2	+ 278.0	50BA+50BB
89	Nutley Tones Owl	67837	3	+ 259.0	33BA+33BD+33DC
90	Owl's Model Fox	76617	2	+ 258.5	50CB+50CC
91	Fontaine's Lodestar	77305	4	+ 252.3	25BB+25BD+50DC
92	Gedney Farm Girl's Oxford	75998	14	+ 238.1	50AA+7AB+7CA+7DA+29DB
93	Eminent 4th	76078	5	+ 237.8	20BD+20CB+20CC+40DC
94	Cinxia's Gamboge Lad	90848	3	+ 212.0	33AB+33BB+33DC
95	Rosaire's Olga Lad	87498	13	+ 210.7	23AA+8AB+15AC+8BA+15BB+8BC+15CA+8DA
96	Keepsake's Golden Lad	71325	5	+ 165.2	20AA+20AB+20BB+20BC+20CB
97	Exile of the Highlands	81869	4	+ 141.2	50BB+50CD
98	Foxy's Fox of Althea	77197	2	+ 129.0	50AB+50CB
99	Gedney Farm Oxford Lad	71238	2	+ 128.0	50CC+50DD
100	Oxford Daisy's Flying Fox	83284	6	+ 117.2	33AB+17AC+17BC+33DA
101	Sayda's Heir 3d	74817	15	+ 106.5	7AB+7AC+7BA+7BB+13BC+7BD+7CB+7CC+13CD+7DA+7DB+7DC+7DD
102	Marigold's Champion	70801	3	+ 67.7	33AB+33CA+33CD
103	The Owl of Meridale	85853	5	+ 66.2	40AB+20BA+20BB+20DD
104	Storr's Golden Lad	68189	2	+ 33.0	50AA+50BB
105	Valentine's Oonan	58076	10	+ 23.0	10CA+40CD+30DC+20DD
106	Prince Noel	74140	4	— 8.8	25BD+25CB+50CD
107	Loretta D's Champion's Son	77002	5	— 16.2	20AB+20BB+20CD+20DA+20DD
108	St. Oner's Torono	81219	2	— 32.0	50AA+50BC
109	Imp. Rozel's Noble	96627	2	— 32.5	50CC+50CD
110	Imp. King of Hambie	65298	2	— 43.5	50DC+50DD
111	Flying Fox's Victor	64768	2	— 57.0	50BD+50DC
112	Oonan's Count	57470	8	— 72.3	13BC+13BD+63DC+13DD
113	Cream Princess' Fritz	65915	2	— 77.0	100AA
114	Nero's Garfield Lad	77949	2	— 82.0	50BA+50BC
115	Mabel's Raleigh	77913	3	— 86.7	33AB+33BA+33BC
116	Pedro's Vidi	71235	2	— 90.5	50BD+50CB
117	Merry Miss' Son	76629	5	— 95.6	20AA+40BC+40CB
118	Seven Gates	75925	5	— 115.2	20AA+20BD+60DC
119	Foxy's Brown Poet	82982	7	— 132.9	14BC+14BD+14CB+29CC+14CD
120	Fontaine's Caiest	81118	5	— 142.8	20AB+20BB+20CB+20DB+20DC
121	Marigold St. Helier	52657	4	— 152.0	25AB+25CB+50CC
122	Mabel's Poet	65780	5	— 161.6	20AA+20BB+20BC+40DD
123	Biltmore's Torment	60761	4	— 165.5	25BC+25CB+25CC+25DD

Bulls in Order of Net Change in Milk of Daughters. —Continued.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change Lbs.	Quartile Changes
124	Fairy Glen's Raleigh	79438	5	— 191.8	40AB+20BC+40CB
125	Golden Alcazar	72800	3	— 231.3	33BA+33BB+33CD
126	Nova Boy of Turner	72135	2	— 248.0	50CB+50CD
127	Rosetta's Golden Lad	73203	5	— 269.2	20BC+20CC+20CD+40DC
128	Sultana's Oxford Lad	76596	3	— 292.0	33AB+33BB
129	Pogis of Goliad	84397	3	— 293.0	67CD+33DD
130	Island Lodestar	67638	6	— 350.4	17AA+33BB+17BD+17CD+17DD
131	Reservation Stoke Pogis	76048	5	— 378.0	20BD+20CC+40CD+20DD
132	Model's Oxford Lad	66518	5	— 417.8	20AA+20BB+20CB+20CC+20CD
133	Guenon's Lad 2d	62304	2	— 425.0	50CB+50CD
134	Meridale Interested Prince	86473	6	— 438.4	17AB+17CB+50CD+17DB
135	Alcarano	69653	4	— 443.2	50AA+25BA+25BD
136	Noble of Oaklands	95700	3	— 453.3	33BC+33CD+33DD
137	Golden Paul	68919	3	— 457.0	33AB+33BD+33DA
138	White Oak Monarch	88433	3	— 462.3	33AC+33CB+33DC
139	Golden Butter Lad	77164	2	— 477.0	100DD
140	Rosaire's Lad of Glenwood	76580	2	— 505.0	50AA+50CB
141	Great Edison	77564	2	— 507.5	50BC+50CC
142	Lady Letty's Victor	65020	15	— 534.5	27AA+7AB+7AC+7BA+7BB+7BC+7BD+7CA+20CB
143	Prince Ramaposa	87833	2	— 537.0	50BC+50CD
144	Inez's Stoke Pogis	51942	4	— 539.5	25AA+25AB+50CB
145	Gertrude's Jap	93947	2	— 542.0	50BA+50BD
146	Eminent 10th	75753	9	— 599.0	22BD+11CC+22CD+44DD
147	Roving Gipsy	67588	2	— 599.5	50BC+50DD
148	Gamboge's Knight	95698	5	— 610.6	20AA+20BC+20CB+40CD
149	Altama's Pogis	77089	3	— 615.7	33BB+33BC+33CD
150	Oonan's Conqueror	77851	2	— 624.0	50CC+50DD
151	Atwell Farm Melia Ann's King	97392	2	— 625.5	50AA+50BC
152	Pogis 75th of Hood Farm	94501	7	— 630.8	57AA+14AB+14BB+14CC
153	King Allie Rioter	62221	2	— 639.5	50BB+50BC
154	Oonan's Major	91036	2	— 644.0	50BD+50DC
155	Hood Farm Torono 20th	82854	19	— 682.9	26AA+5AB+5AC+16AD+5BC+11CA+11CC+5CD+5DA+5DB+5DD
156	Olga Hazel Pogis	95042	2	— 698.5	50BC+50CD
157	Irene's King Pogis	73182	16	— 761.8	6AB+6AC+25BD+12CB+12CC+25CD+6DA+6DC
158	Jersey Lad's Caspar	71077	5	— 767.0	20AA+20BC+20BD+20CB+20DC
159	Hood Farm Torono 21st	83413	4	— 800.5	50BD+25CC+25DD
160	Melia Ann's Berkshire	66373	2	— 801.5	50BC+50DD
161	Tonona Pogis	78657	14	— 826.1	21AA+14AB+7AC+14AD+7BA+7BB+7BC+7CB+7DD
162	Mistletoe Pogis	75371	2	— 826.5	50BD+50DC
163	Valentine's Count	69878	6	— 830.1	17CD+83DD
164	Lord North	75342	2	— 830.5	50AA+50AB
165	Eurybia's Son	68790	3	— 836.6	33BB+33BD+33DC
166	Oxford's Brigadier	78529	2	— 848.0	50AA+50AB
167	Minaret Exile	56933	9	— 851.0	11AA+11AB+22AC+22BB+11BD+11CB+11DC
168	Portland Prospect	61919	3	— 858.7	33AA+33AC+33BA
169	Fontaine's Duke	61709	6	— 861.7	17AA+17AB+33BA+17BB+17BC+20BB+20BC+60CD
170	Brown Lassie's Compass	71626	5	— 869.6	20BB+20BC+60CD
171	Pedro of Brick House Farm	88867	3	— 883.7	33BC+33CD+33DD
172	Golden Laddie of C.	67925	3	— 889.7	33AD+33BA+33CD
173	Pogis 94th of Hood Farm	90492	2	—1038.5	50BD+50DD
174	H. F. Golden Fern's Lad	80437	7	—1048.7	14AB+14AD+14BA+14BD+14CD+14DC+14DD
175	Merry Maiden's Grandson	71003	6	—1062.7	17AA+17AB+17BB+17BC+17CC+17DA

Bulls in Order of Net Change in Milk of Daughters. —Concluded.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change Lbs.	Quartile Changes
176	Pogis 95th of Hood Farm	92626	5	—1075.2	20AA+20AD+20BA+20BC+20CA
177	Fort Hill Farm Torono	72940	2	—1079.0	50BC+50CD
178	Financial Raleigh	86298	4	—1092.0	50AA+25AB+25DC
179	Quintin Owl	77041	3	—1124.4	33AD+67DD
180	Pogis Alden Boy	96014	2	—1129.5	100CD
181	St. Mawes	72053	2	—1196.5	100BC
182	Marigold's Exile King	53232	8	—1242.3	25AA+50BC+13BD+13CD
183	Tormentor's Torono	78184	5	—1245.4	20AC+40CD+20DB+20DD
184	Ben Hur Pogis	38370	2	—1264.5	50AA+50BB
185	Romeo of Sheomet	62715	4	—1267.2	75CD+25DD
186	Sensational Fern	75924	3	—1286.0	33BB+33BD+33DD
187	Fad	85670	2	—1318.5	50BD+50DD
188	Gertie's Son's Boy	71825	2	—1328.0	50AA+50AB
189	Noble Peer	90653	4	—1431.3	75AB+25CB
190	Gamboge's Oxford Lad	67284	2	—1441.5	50AC+50BC
191	Golden Lucy's Eminent Lad	85639	7	—1458.1	29AB+14AD+14BA+14BB+14BD+14DD
192	Amy's Chief	74154	4	—1504.3	50AA+50BD
193	Altama Interest	98466	4	—1526.2	25AC+25BB+25BD+25CD
194	The Imported Jap	75265	11	—1533.4	9AA+18AB+9AD+9BA+9BD+9CC+18CD+18DD
195	Glory's Pedro	95123	2	—1538.5	50BC+50CD
196	Jubilee of Bois d'Arc	29041	3	—1542.3	33AD+33BC+33BD
197	Mona Rose's Glory	92531	5	—1550.4	20AA+20AB+20AC+20AD+20CD
198	Gertie's Son's Jamont	73745	2	—1649.5	50AA+50AD
199	Noble's Jolly Golden Lad	104562	2	—1769.5	50BC+50BD
200	Cowslip's Ashley	83633	3	—1846.7	33AD+33CC+33CD
201	Fontaine's Count	84083	2	—1872.0	50AD+50DC
202	St. Helier of Sheomet	61765	3	—1874.0	67BD+33CC
203	Fern's Air	77589	2	—1945.0	50AC+50CD
204	Daisy's Prince of St. L.	75437	2	—1959.0	50AA+50AC
205	Harry B. Gordon	47246	2	—1989.0	100AB
206	Gazelle's Fawn Rioter King	71966	3	—1989.4	33AD+33CC+33DD
207	Oonan 23d's Grandson	74887	3	—2031.3	33AD+33BB+33BC
208	Combination Golden Lad	59292	3	—2032.3	33AB+33BB+33CB
209	Oaklands Sultan King	85602	2	—2052.5	50AA+50CD
210	Jacoba Emanon	84177	9	—2190.9	22AB+33AC+11BB+22BC+11CC
211	Lady Mary's Fox	82763	2	—2236.5	50AC+50BC
212	Jacoba's Premier	89296	3	—2363.3	33AC+33CB+33DC
213	Girldine's Champion Pogis	94004	3	—2380.0	33AD+33BC+33CC
214	Adelaide's Merry Pogis	91365	3	—2485.7	33AA+33AB+33AC
215	Margery Golden's Fox	72362	4	—2503.7	25AD+50BD+25CC
216	Gertie's Son of Washington	83799	3	—2593.4	33AA+67AB
217	Benedictine King	86100	2	—2617.5	50AA+50AB
218	King's Rioter Lawrence	65453	2	—2760.5	50AB+50AD
219	Viola's Golden Jolly	79314	2	—2957.0	50AD+50CD
220	Rosaire's Golden Lad	64554	2	—3387.0	100AA
221	Violet's Oakland Count	80974	2	—3494.5	50AD+50CB
222	Hector Marigold	59121	2	—3507.0	50AC+50BD
223	Oxford Lad's Owl	75599	2	—3743.5	100AD
224	Hood Farm S. Tormentor	76311	3	—3979.0	33AA+33AB+33BD

There are in this table 224 bulls with two or more daughter-dam pairs. Of this number of bulls 105 or slightly less than half raise the milk production of their daughters over the milk production of their dams.

No. 1. Queen's Raleigh 88232, with his daughters from tested dams, stood first among all the Jersey sires as the bull

who raised the production of his daughters over that of their dams to the greatest amount. This increase in production was 4545.7 pounds of milk in a year. This bull was bred to two B class dams and one D class. The daughters from this mating were both in the A class.

No. 2. Sans Aloi, the sire of Financial Beauty 271399, the dam of the $60,000 bull Financial Sensation 153793, raised the milk production of his daughters over that of their dams to the next highest amount, +4464.5. He was bred to only two tested dams and these were of the D class. His daughters from that mating were of the A class.

In a similar fashion the record of each bull is presented. We might pick out other bulls of famous stock like Chief Engineer (18) or Golden Glow's Chief (19) the sire of Vive la France as bulls who very evidently improved the breed as their daughters' production attests. Instead of choosing such a list at random let us take the list of leading native sires and the list of leading imported sires as given by John R. Sibley (13,14) and examine their merit as shown by this table and the subsequent tables.

The leading native bulls are, omitting those which do not have at least two daughter-dam pairs:

Hood Farm Pogis 9th	(76)	+ 448.9	Not significant
Hood Farm Torono	(12)	+2620.1	Significant
Spermfield Owl	(31)	+1695.7	Significant
Loretta's King	(61)	+1000.2	Probably significant
Sayda's Heir 3d	(101)	+ 106.5	Not significant
Hector Marigold	(222)	—3507.0	Significant
Irene's King Pogis	(157)	— 761.8	Probably not significant
Lady Letty's Victor	(142)	— 534.5	Probably not significant

The leading imported sires are, omitting those which do not have at least two daughter-dam pairs:

Interested Prince	(81)	+ 401.8	Not significant
Raleigh's Fairy Boy	(74)	+ 453.8	Not significant
Gamboge's Knight	(148)	— 610.6	Not significant
Royal Majesty	(21)	+2138.6	Probably significant
Noble of Oaklands	(136)	— 453.3	Not significant
Eminent's Raleigh	(44)	+1325.0	Not significant
The Imported Jap	(194)	—1533.4	Probably significant
Gedney Farm Oxford Lad	(99)	+ 128.0	Not significant

After the name of these leading bulls is placed the number designating their place in table 4. The next column following gives the gain or loss of the daughter's average milk production as compared with the average milk production of their dams. In the last column is given the probable significance of the difference between the daughters' average milk yield and their dams' average milk yield for any given sire. The significance of these differences depend on the amount of the difference and on the number of offspring. The probable errors on which the significance of the differences depend are given in table 3.

In the first group of leading Native Sires it is clear that Hood Farm Torono leads in the increasing of milk production of his progeny over that of the dams from which these progeny sprang.

The clear merit of this bull makes his pedigree of a good deal of interest.

Pedigree of Hood Farm Torono 60326.

Maine Agr. Exp. Sta.—Standard Pedigree Blank

Sheet No.

Sex ♂

No. 60326 Hood Farm Torono

♂	No. 20883 ♂ Sophie's Tormentor	No. 3533 ♂ Tormentor ⊕	No. P. S. 103 Khedive ♂ ⊕	
			No. F. S. 1607 Angela ♀ ⊕	
		No. 17615 ♀ Baron's Sophie	No. P. S. 289 Baron ♂	
			No. F. S. 434 Sophie ♀	
	No. 48723 ♀ Rhoda Hudson	No. 3761 ♂ Catono	No. ♂	
			No. 7849 ♀ Ora	
No. 25204 Torono		No. 5704 ♀ Rosabel Hudson	No. 918 ♂ Oneco	
			No. 2877 ♀ Arabel Hudson	
♀	No. 3533 ♂ Tormentor	No. P. S. 103 ♂ Khedive	No. 198 ♂ S. Leo	
			No. 1442 ♀ D. Coomassie	
		No. F. S. 1607 ♀ Angela	No. ♂	
			No. ♀	
	No. 41428 ♀ Addie P.	No. 13658 ♂ Ida's Stoke Pogis	No. 4558 ♂ Bachelor of St. Lambert	
			No. 24990 ♀ Ida of St. Lambert	
No. 50832 Tormentor's Lass		No. 32915 ♀ Sigletta	No. 4027 ♂ Signalda	
			No. 19567 ♀ Kathletta	

The pedigree shows Hood Farm Torono an inbred Tormentor bull, Tormentor occurring on both sides of the pedigree. On the whole he is not very near to island stock, the first appearance of it coming in the third generation.

Spermfield's Owl is a fairly close second to Hood Farm Torono when the milk production and numbers of his offspring, etc. are considered. Hector Marigold is the poorest of these sires as his progeny are 3507.0 pounds of milk below the production of their dams. This is, however, based on only two daughter-dam pairs (See table 3 for the probable errors). Out of these leading bulls five increased and three decreased the production of their progeny. Within this number the milk production of the daughters of two sires was significantly raised. The milk production of the daughters of another plus sire was probably significantly raised. In the not significantly raised group there were two sires. Of the sires which lowered the milk yield one significantly lowered it and two lowered it by an amount which was probably not significant.

In the group of leading imported sires Royal Majesty proved the best with 2138.6 pounds of milk for his daughters' production over the production of their dams. Second to this bull is Eminent's Raleigh with 1325.0 pounds of milk that each of his daughters averaged more than the production of their dams. The poorest of these bulls is The Imported Jap as he lowered the average milk production of his daughters 1533.4 pounds. Considering the probable significance of the daughter-dam difference for each sire, it is found that within the plus group there was one difference, probably significant; and four differences, not significant. In the minus two differences were not significant and one was probably significant.

These facts reveal a slight superiority of the native sires as compared with the imported sires.

Of considerable importance in judging these bulls' merits in transmitting milk production to their offspring is the relative position occupied by the dam's milk production as compared with her daughters. This is shown for the above bulls in the last column of table 4. The two leading native bulls Hood Farm Torono and Spermfield's Owl may be compared. Hood Farm Torono was bred to 29 per cent of class A cows. From these he produced 26 per cent class A daughters and 3 per cent

of class B daughters. Spermfield's Owl was bred to 20 per cent class A cows. From these he produced 12 per cent class A daughters, 4 class B daughters and 4 class C daughters. In this particular Hood Farm Torono maintained the production of his daughters better than Spermfield Owl. Hood Farm Torono was bred to 15 per cent of dams in class B. From these he produced 9 per cent class A daughters, 3 per cent class B and 3 per cent class C. Spermfield Owl was bred to 38 per cent class B dams. From these he produced 23 per cent class A, 12 class B and 4 class C daughters. In their abilities to raise the production of the class B cows the bulls are consequently of about equal merit. Hood Farm Torono was bred to 41 per cent class C dams. From these he produced 32 per cent class A daughters and 9 per cent class B. Spermfield Owl was bred to 20 per cent class C dams. From these he produced 8 class A daughters, 8 class B and 4 class D. Hood Farm Torono is better able to raise the production of the class C dams than is Spermfield Owl. Of the class D dams Hood Farm Torono is bred to 15. The progeny from this mating were 9 in class A, 3 in class B and 3 in class C. Spermfield Owl was bred to 24 class D cows. The offspring of this mating were 12 in class A, 4 in class B and 8 in class D. Hood Farm Torono consequently raised the milk production of his daughters from D dams more than did Spermfield Owl.

The examination of the milk transmitting qualities of the poorest bull in this group of native sires, Hector Marigold, shows that this bull lowered the milk production of his daughters from both class A and class B dams.

As above pointed out the bull of merit in the imported list is Royal Majesty. Royal Majesty maintained the production of the class A cows to which he was mated in their offspring. He raised the production of the other classes of cows to which he was mated. The poorest performance of the imported bulls, The Imported Jap, lowered the production of his daughters over that of their dams in all but one case.

This table may also be used to determine the worth of a sire through the production of his sons. Thus Eminent has six sons in this table. These sons have a total of 24 daughter-dam pairs, four of these sons raise the milk production of their daughters over that of their dams and two lower the produc-

tion. The net result for Eminent's transmitting qualities for milk production is that he transmitted to his sons' milk producing qualities to cause these sons to raise the milk production of their daughters 803.1 pounds of milk over their dam's production.

This phase of the subject will be discussed more fully in a later section of this paper.

THE TRANSMITTING QUALITIES OF JERSEY SIRES FOR BUTTER-FAT PERCENTAGE.

The arrangement of table 5 containing this information is entirely similar to that of table 4. In this table is given all Registry of Merit bulls which have two or more daughters tested for year butter-fat percentage from dams of known year butter-fat percentage. These bulls are arranged in accordance with the butter-fat percentage by which the daughter's milk was in excess or defect of the butter-fat percentage of the dam's milk, symbolically expressed.

Sire's Transmitting Qualities for Butter-Fat Percentage= Daughter's Butter-Fat Percentage-Dam's Butter-Fat Percentage.

This information is given in the fifth column of the table. The bulls as in the previous table are numbered in accordance with the position they occupy in the table. This number is given in the first column. The second and third columns are given over to the names and numbers of the different bulls. In the fourth column are the numbers of daughter-dam pairs on which the progeny test rest. The fifth column gives the net change in the butter-fat percentage as above discussed. The sixth column gives the quartile in which the given daughter's butter-fat percentage and the dam's butter-fat percentage occur. Each daughter-dam pair is described by two letters. The quartiles are shown in figure 25 for the daughter's butter-fat percentage and for the dam's butter-fat percentage. Table 1 gives the frequency distribution and table 2 gives the limits of each quartile. The quartiles are designated as A, the highest butter-fat percentage group; B, the next highest butter-fat percentage group; C, the third highest butter-fat percentage group; and D, the lowest butter-fat percentage group. As the name sig-

nifies each quartile contains one-fourth the total number of individuals in the whole population. The letter consequently gives the place for their respective populations in which the dam's or daughter's butter-fat percentage falls. The letters together give the relation of the dam's position to that of the daughters. Thus AC tell us (the dam's letter is always placed first) that the dam's butter-fat percentage was in the highest group or above 5.995 per cent and the daughter's butter-fat percentage is the third group or between 5.174 and 5.559 per cent.

The coefficients in front of the letters signify the percentage that a given kind of daughter-dam pair was of the total number of pairs into which the bull entered. This coefficient is multiplied by 100 to have the coefficient in whole numbers. With this arrangement it is possible to tell to what kind of dams a bull was mated and what his daughters from these matings did.

TABLE 5.

Bulls in Order of Net Change in Butter-Fat Percentage of Daughters.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change %	Quartile Changes
1	Clear Brook Chief	74685	2	+1.338	100DA
2	Violet's Oakland Count	80974	2	+1.100	50CA+50DB
3	Great Edison	77564	2	+1.022	50CA+50DC
4	Nora Boy of Turner	72135	2	+0.893	50DA+50DB
5	Viola's Golden Jolly	79314	3	+0.888	33AA+33CA+33DB
6	Atwell Farm Melia Ann's King	97392	2	+0.757	50CB+50DO
7	Noble's Jolly Golden Lad	104562	2	+0.682	50DB+50DD
8	Irene's King Pogis	73182	17	+0.650	18AA+12BA+6BB+6BC+18OA +12CB+6CC+18DA+6DB
9	Hector Marigold	59121	3	+0.617	33AB+33DA+33DB
10	Merry Maiden's Grandson	71003	6	+0.560	33BA+17BB+33CA+17DC
11	King's Rioter Lawrence	65453	2	+0.540	50DB+50DC
12	Glory's Pedro	95123	2	+0.540	50BA+50CB
13	Pogis 75th of Hood Farm	94501	7	+0.518	14BC+43CA+14CB+14DO+ 14DD
14	Jacoba's Emanon	84177	9	+0.512	22AA+33BA+33BB+11CA
15	Marigold's Exile King	53232	8	+0.500	13AA+13BA+25CA+13CB+ 25CC+13DC
16	Romeo of Sheomet	62715	4	+0.497	25CA+25CB+25DB+25DC
17	Golden Fern's Son	78687	10	+0.458	10AA+20BA+10BC+10CA+ 20CB+10CC+10DA+10DB
18	Girldine's Champion Pogis	94004	3	+0.453	33CA+33CC+33DB
19	Golden Glow's Chief	61460	4	+0.453	25BA+75DO
20	Loretta D's Champion's Son	77002	7	+0.441	14DB+43DC+43DD
21	Nebraska Lad	71828	2	+0.439	50BA+50DD

Bulls in Order of Net Change in Butter-Fat Percentage of Daughters—Continued.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change %	Quartile Changes
22	Golden Butter Lad	77164	2	+0.433	50BA+50BC
23	Golden Alcazar	72800	3	+0.431	33BA+33CB+33DD
24	Margery Golden's Fox	72362	4	+0.414	50AA+25CA+25CB
25	Eurybia's Son	68790	3	+0.405	33AA+33DB+33DD
26	Noble of Oaklands	95700	3	+0.386	33AA+33CA+33CB
27	Sultan of Oaklands	78475	3	+0.385	33BA+33BB+33DB
28	Pogis 66th of Hood Farm	85015	3	+0.385	33CB+33CC+33DD
29	Gertie's Son's Jamont	73745	2	+0.368	50CD+50DC
30	Daisy's Prince of St. L.	75437	2	+0.352	50AA+50DD
31	Fontaine's Count	84083	2	+0.335	50AB+50DA
32	Benedictine King	86100	2	+0.330	100DD
33	Tonona Pogis	78657	14	+0.329	21AA+7AC+7BB+14CA+14CB+21CC+14DB
34	Altama Interest	98466	4	+0.315	25AA+25CB+25CC+25DB
35	Imp. Rozel's Noble	96627	2	+0.304	50BB+50DB
36	Rosaire's Golden Lad	64554	2	+0.293	50CA+50CC
37	Tormentor's Landseer Signal	69291	4	+0.292	50CB+25DB+25DD
38	Nero's Garfield Lad	77949	2	+0.286	50DC+50DD
39	Flying Fox's Victor	64768	4	+0.281	50AA+25DA+25DC
40	Sensational Fern	75924	4	+0.275	25BC+25CA+25CC+25DC
41	Adelaide's Merry Pogis	91365	3	+0.272	33BC+33CB+33DB
42	Hood Farm Torono 21st	83413	4	+0.272	25AB+25DB+25DC+25DD
43	The Imported Jap	75265	13	+0.269	8AA+15AB+8BA+8BB+8BD+15CA+8CB+8DB+8DC+15DD
44	Chenille's Golden Prince	91769	2	+0.264	50CB+50DD
45	Oxford Lad's Owl	75599	2	+0.262	50DC+50DD
46	Gazelle's Fawn Rioter King	71966	3	+0.260	33AA+33BA+33CB
47	Jersey Lad's Caspar	71007	5	+0.254	20AA+40BA+20BB+20BC
48	Eurybia's Blue Boy	90591	3	+0.253	33AA+33BC+33DD
49	Keepsake's Golden Lad	71325	7	+0.244	14CB+14CC+29DC+43DD
50	Hood Farm Pogis 9th	55552	42	+0.243	12AB+2BA+2BB+2BC+2BD+2CA+17CB+17CC+5CD+5DA+12DB+14DC+7DD
51	Jacoba's Premier	89296	4	+0.236	25AA+50BA+25DC
52	Portland Prospect	61919	4	+0.236	25BB+25DB+50DD
53	Oxford's Brigadier	78529	3	+0.230	33BC+33CB+33DD
54	Pogis 99th of Hood Farm	94502	14	+0.230	7AA+14BA+14BB+14BC+21CB+7CC+7DC+14DD
55	St. Oner's Torono	81219	3	+0.226	33CA+67CC
56	The Owl of Meridale	85853	5	+0.218	20AA+20BB+40DC+20DD
57	Pogis Alden Boy	96014	2	+0.208	50CB+50CC
58	Pogis 95th of Hood Farm	92626	5	+0.205	20AA+20BA+20BB+20DB+20DD
59	Golden Lucy's Eminent Lad	85639	7	+0.202	14BB+14CA+14CB+29CC+14CD+14DC
60	Signal's Successor	72758	3	+0.202	33BB+33CC+33DD
61	Torono	25204	4	+0.176	25BC+50DC+25DD
62	Model's Oxford Lad	66518	6	+0.176	17BA+17BC+17CA+33CC+17CD
63	Nutley Tones Owl	67837	3	+0.174	33AA+33CB+33DC
64	White Oak Monarch	88433	3	+0.168	33AA+33BB+33CB
65	Sayda's Heir 3d	74817	16	+0.166	6AA+19BA+25BB+25BC+6CA+6CB+6CC+6DB
66	Cowslip's Ashley	83633	3	+0.165	33AC+33CC+33DA
67	Oonan's Conqueror	77851	2	+0.155	50AA+50BB
68	Cream Princess Fritz	65915	2	+0.155	50DC+50DD
69	Quintin Owl	77041	3	+0.152	33AA+33BA+33DC
70	Oonan's Count	57470	8	+0.150	13AA+13AB+37BA+25BB+13CA
71	Gamboge's Knight	95698	5	+0.148	20AA+20CA+20CB+40DD
72	Channel King	62762	2	+0.148	50BA+50BB
73	Gamboge's Oxford Lad	67284	2	+0.143	50BB+50DD
74	Valentine's Count	69878	6	+0.139	50AA+17AB+17BB+17DA
75	Blue Belle's Gold Farm	79043	3	+0.139	33CB+33CC+33DD

Bulls in Order of Net Change in Butter-Fat Percentage of Daughters—Continued.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change %	Quartile Changes
76	Marigold St. Helier	52657	5	+0.136	20DB+20DC+60DD
77	Lady Letty's Victor	65020	15	+0.134	7AA+13BA+13BB+7BC+13CA +7CB+13CC+7CD+20DD
78	Mabel's Raleigh	P.S. 3722 H.C.	3	+0.133	67CC+33DC
79	Amy's Chief	74154	4	+0.124	25AA+25AB+50CB
80	Majestic Fern	84428	3	+0.123	33AA+33AD+33BA
81	Oonan's Major	91036	2	+0.118	50BB+50DC
82	Guenon's Lad 2d	62304	2	+0.118	50AA+50CA
83	Foxy's Brown Poet	82982	7	+0.118	14AA+14AC+14BA+14BB+ 29CA+14DD
84	Flying Fox's Oxford Duke 2d	76316	2	+0.100	50CB+50CC
85	Eminent 4th	76078	5	+0.084	40AA+20AC+20BA+20CA
86	Storrs. Golden Lad	68189	2	+0.078	50CB+50CD
87	Pogis of Goliad	84397	3	+0.060	33BA+33BC+33CB
88	Rosetta's Golden Lad	73203	5	+0.060	40BB+20DB+40DC
89	Hood Farm S. Tormentor	76311	4	+0.057	25AB+25BB+25CA+25CD
90	Pedro's Vidi	71235	2	+0.056	50AA+50BB
91	Fern's Air	77589	2	+0.055	100AA
92	Valentine's Oonan	58076	10	+0.048	40AA+10AC+20BA+20BB+ 10CB
93	Hood Farm Pogis 34th	63300	2	+0.044	50AB+50BA
94	Melia Ann's Berkshire	66373	2	+0.035	50BB+50DC
95	Oaklands Sultan King	85602	2	+0.033	50CC+50DD
96	Jenny's Redfern	70388	2	+0.030	100DD
97	Mabel's Raleigh	77913	3	+0.027	33CC+33CD+33DD
98	Springfield Owl	57088	27	+0.027	22AA+4AB+7BA+11BB+4CA +11CB+15CD+11DC+15DD
99	Alcarano	69653	4	+0.019	25AA+25BA+25BC+25CD
100	Rioter's Jersey Lad	58301	9	+0.019	22AA+11AC+56BA+11BD
101	Ben Hur Pogis	38370	3	+0.017	33AA+33BC+33DC
102	Interested Prince	58224	25	—0.012	4AA+8AB+4AC+8AD+8BA+ 12BB+4BC+4BD+4CA+8CB +8CC+4CD+4DA+4DB+ 4DC+12DD
103	Meridale Interested Prince	86473	6	—0.014	33AA+17AB+17BA+17DC+ 17DD
104	Bessie Bate's Lad	78296	2	—0.016	100DD
105	Mistletoe Pogis	75371	2	—0.044	50AA+50AB
106	Foxy's Fox of Althea	77197	2	—0.057	50CC+50DC
107	Exile of the Highlands	81869	4	—0.058	25AB+25AC+25BA+25BB
108	St. Mawes	72053	2	—0.064	50AA+50AB
109	Gedney Farm Oxford Lad	71238	2	—0.071	50BC+50CB
110	Hood Farm Torono 20th	82854	19	—0.072	11AA+5AB+5AC+11BB+11BC +5BD+5CA+11CB+5CC+ 16CD+5DB+5DC+5DD
111	Fad	85670	2	—0.074	50AA+50BC
112	Fontaine's Caiest	81118	5	—0.077	40BC+20CB+20DC+20DD
113	Gertrude's Jap	93947	3	—0.080	67BB+33BC
114	Roma's Rioter of St. L.	70951	3	—0.081	33AA+67BB
115	Baronetti's Golden Lad	67908	2	—0.081	50AC+50DC
116	Golden Shylock	81862	6	—0.086	33AB+17BB+17CB+17CD+ 17DC
117	Olga Hazel Pogis	95042	2	—0.094	50AB+50DD
118	Oxford King of Fernwood	81379	3	—0.098	33CB+33CD+33DD
119	Oxford Lass's Cream King	81359	3	—0.105	100CC
120	King Allie Rioter	62221	2	—0.115	50BC+50DD
121	G. G. Chief of Ashburn	86044	3	—0.122	33AB+33AC+33DB
122	Prince Ramaposa	87833	2	—0.128	50AC+50DC
123	My Jubilee	75742	2	—0.128	100DD
124	Melia Ann's King 9th	74917	2	—0.136	50AB+50BA
125	Harry B. Gordon	47246	2	—0.138	100BC
126	Brown Bessie's Columbus	68364	3	—0.146	33DC+67DD
127	Prince Noel	74140	4	—0.148	25AA+25AB+25AD+25CA

Bulls in Order of Net Change in Butter-Fat Percentage of Daughters—Continued.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change %	Quartile Changes
128	Noble Peer	90653	4	—0.152	25AA+25BB+25BC+25CC
129	Dorinda Darling's Diploma	71816	6	—0.156	17AB+17BB+17BC+17CC+33DD
130	Romulus of Spring Hill	78837	4	—0.160	75AA+25DA
131	Hood Farm Golden Lad	64268	7	—0.167	14AB+14BD+29CC+14CD+29DD
132	Golden Laddie of C.	67925	3	—0.170	67BD+33DD
133	The Warden's Sir Prince King	89421	2	—0.186	50BD+50DD
134	St. Lambert's Ridgewood King	73247	2	—0.193	50CD+50DD
135	Gertie's Stoke Pogis	56492	3	—0.196	33BA+67CD
136	Rosaire's Lad of Glenwood	76580	2	—0.198	50BB+50BC
137	Reservation Stoke Pogis	76048	5	—0.211	20AB+20AC+20CB+20CD+20DC
138	Pogis 94th of Hood Farm	90492	2	—0.215	50AC+50CB
139	Hood Farm Figgis Torono	90517	3	—0.216	33AB+33BB+33DC
140	Altama's Pogis	77089	3	—0.217	33BB+33BC+33CC
141	Merry Miss' Son	76629	6	—0.221	33AB+17CC+50DD
142	Hood Farm Torono	60326	41	—0.225	7AA+12AB+12AC+5AD+2BA 5BB+2BC+2BD+12CB+20C +15CD+2DB+12DC+7DD
143	Rearguard	70962	2	—0.230	50CC+50CD
144	Oxford Daisy's Flying Fox	83284	6	—0.244	17BD+33CD+17DB+17DC+17DD
145	Lord North	75342	2	—0.249	100DD
146	Oxford's Fairy Boy	92821	3	—0.249	33BA+33BD+33CD
147	You'll Do Oxford	98772	2	—0.254	50BB+50BC
148	Tormentor's Torono	78184	5	—0.256	20AB+20AC+ 20CB+20CD+20DC
149	Seven Gates	75925	5	—0.260	20AA+20AB+20BC+20CD+20DC
150	Royal Majesty	79313	5	—0.264	20AD+20CD+20DC+40DD
151	Forfarshire's King Dalton	95339	7	—0.266	14AA+14AB+14BD+29CC+14CD+14DC
152	Sultana's Oxford Lad	76506	3	—0.267	33AA+33AB+33CD
153	Lady Mary's Fox	82763	2	—0.268	50AA+50DD
154	Foxhall's Jubilee	76944	10	—0.269	10BC+20BD+10CD+60DD
155	Mona Rose's Glory	92531	5	—0.270	20BB+20BC+20BD+20DC+20DD
156	Fontaine's Duke	61709	8	—0.275	13AA+13AD+13BD+37CD+13DC+13DD
157	The Plymouth Lad	89792	4	—0.281	25BC+75CD
158	Fairy Glen's Raleigh	79438	6	—0.291	17AB+17AC+17AD+17BB+17CD+17DB
159	Pedro of Brick House Farm	88867	3	—0.295	100AA
160	Combination Golden Lad	59292	4	—0.299	25BC+25CC+25CD+25DD
161	Mabel's Poet	65780	5	—0.310	20BB+40BC+20BD+20CC
162	Oonan 23d's Grandson	74887	3	—0.323	33AA+33AB+33AC
163	Gertie's Son's Boy	71825	2	—0.324	50BD+50DD
164	Cinxia's Gamboge Lad	90848	3	—0.326	67AA+33BD
165	Inez's Stoke Pogis	51942	4	—0.339	25AD+25BD+25CB+25CD
166	Eminent 10th	75753	10	—0.346	10AD+20BB+20BC+30BD+10CA+10CC
167	Karnak's Noble	87952	4	—0.348	25BD+25CC+25DC+25DD
168	Fontaine's King	65641	2	—0.352	50AB+50CD
169	Roving Gipsy	67588	2	—0.355	50AA+50BB
170	H. F. Golden Fern's Lad	80437	7	—0.361	14AA+14AB+14BC+14BD+43CD
171	Lookout Torono	78593	17	—0.365	18AA+35AB+12AC+6BA+12BB+6BC+6CA+6CC
172	Hazel Fern Golden King	77872	8	—0.394	13BB+25BC+25BD+13CA+13CD+13DD
173	Sans Aloi	81012	2	—0.398	50AB+50DD
174	Golden Lad of Glenwood Farm	62057	3	—0.399	33BB+33BC+33BD

Bulls in Order of Net Change in Butter-Fat Percentage of Daughters—Concluded.

No.	Name of Bull	Registry Number	Number of Pairs	Net Change %	Quartile Changes
175	St. Helier of Sheomet	61765	3	—0.400	33AA+33AB+33BB
176	Hood Farm Golden Lad 4th	71215	3	—0.420	33AD+33CD+33DC
177	Lord Letta of Meridale	55716	2	—0.430	100CD
178	Loretta's King	65050	19	—0.430	11AA+16AC+16AD+5BB+5BC +5BD+5CA+5CC+21CD+ 5DC+5DD
179	Golden Paul	68919	3	—0.450	67BC+33BD
180	Fort Hill Farm Torono	72940	2	—0.455	50AB+50AC
181	Fontaine's Lodestar	77395	4	—9.468	25BC+25BD+25CD+25DD
182	Spermfield Owl 2d	93634	2	—0.482	50AD+50DD
183	Rosaire's Olga Lad	87498	13	—0.482	69AB+8AC+8BB+8BD+8DB
184	Biltmore's Torment	60761	5	—0.492	20AC+60BB+20BD
185	The Owl's Double Grandson	80314	6	—0.492	17AD+17BB+17BD+17CD+ 33DD
186	Imp. Noble Fontaine Raleigh	91142	5	—0.492	20AC+20AD+20CC+20CD+ 20DB
187	Golden Lad of Summit	85396	6	—0.495	67AA+17AD+17DD
188	Marston's Interested Prince	71855	10	—0.508	10AA+10AB+10AC+20AD+ 10BB+30BD+10CD
189	Tormentor Summit Lad	68620	6	—0.526	50AA+17AB+17AC+17AD
190	Lad's Oxfordshire	74564	2	—0.535	50AD+50DD
191	Golden Nero	62052	2	—0.543	100AB
192	Eminent's Tormentor	85936	2	—0.544	50AB+50AC
193	Marigold's Champion	70801	3	—0.547	33BD+33CD+33DD
194	Financial Raleigh	86298	4	—0.554	25AC+75DD
195	Island Lodestar	67638	6	—0.563	33AB+17AC+17CD+17DB+ 17DC
196	Minaret Exile	56933	10	—0.574	10AB+10AC+10AD+10BB+ 10BC+30CD+20DD
197	Gedney Farm Girl's Oxford	75998	14	—0.576	21AB+7BC+7CC+36CD+29DD
198	Nimbus of Brondale	69704	3	—0.577	33AB+33BC+33BD
199	Agatha's Brookhill Fox	69633	2	—0.588	50AB+50DC
200	Eminent of Acca Farm	84617	3	—0.597	33AD+33BC+33CC
201	Imp. King of Hambie	65298	2	—0.599	50AB+50AC
202	Brown Lassie's Compass	71626	5	—0.604	20AA+20AC+20BD+20CC+ 20CD
203	Melia Ann's Hero of 4th	84061	3	—0.605	67AA+33BB
204	Gertie's Son of Washington	83799	3	—0.619	67AB+33AC
205	Taurus Perfection	80132	2	—0.622	50AB+50BD
206	Naida's Golden Lad	67475	3	—0.622	33CD+67DD
207	Fairfield's Chancellor	74363	2	—0.654	50AD+50CB
208	Willson's Exile	44065	2	—0.656	50AB+50BD
209	Anderson's King	75247	2	—0.658	100AB
210	Chief Engineer	47148	7	—0.684	14AB+29AC+14BD+14CC+ 14DC+14DD
211	Lady Letty 4th's Rioter	76533	2	—0.684	50BD+50DD
212	Raleigh's Fairy Boy	83767	10	—0.714	10AD+20BD+40CD+30DD
213	Owl's Model Fox	76617	2	—0.717	100BD
214	Eva's Grey Fox	72444	2	—0.731	100CD
215	The Warden	77015	12	—0.732	24AC+8AD+8BB+25BD+8CB +17CD+8DD
216	Mr. Inez Marigold Pedro	79701	3	—0.748	33BD+67CD
217	Rinda Lad of S. B.	89518	2	—0.802	50AB+50AD
218	Temisia's Interested Prince	71648	2	—0.804	50BC+50BD
219	Jubilee of Bois d'Arc	29041	4	—0.810	25AA+25AB+25AD+25CD
220	Oxford John D.	90048	3	—0.856	33AC+67BD
221	Rochette's Noble	96422	2	—0.864	50AA+50AD
222	Copper Baron	64453	2	—0.988	50AC+50AD
223	Eminent's Pilot	75364	3	—1.107	33AC+33AD+33CD
224	Eminent's Raleigh	69011	2	—1.165	50AD+50BD
225	Queen's Raleigh	88232	3	—1.199	67BD+33DD

There are in this list 225 bulls which have two or more daughters from tested dams. Of these bulls 101 raised the butter-fat percentage of their daughters over that of their dams. The number of bulls which improved the Jersey breed were somewhat less than half of those in use. In this list the greatest number of daughter-dam pairs for any given bull is 42 for Hood Farm Stoke Pogis 9th. A close second to him is Hood Farm Torono with 41 pairs.

The bull which caused his daughters to have the highest butter-fat percentage over that of the butter-fat percentage of their dams, was the bull Clear Brook Chief (1). This bull raised the butter-fat test of his daughters 1.338 per cent of butter-fat from class D dams he raised his daughters to class A. In this case there were only 2 daughter-dam pairs to base this judgment as to the bull's worth, but even so, the probable errors shown in table 3 indicate that in this case the rise is probably significant in the statistical sense.

Of the bulls with a larger number of daughters Irene's King Pogis is the leader raising the production of his daughters' (0.650) per cent butter-fat over that of their dams'.

It is of interest to take the lists of leading native and imported sires for illustration of the use of this table as was done for the table showing the transmitting qualities of Jersey sires for milk production. The sires are listed below in the two groups. Their number in table 5 and the amount of butter-fat percentage by which they raised and lowered the butter-fat percentage of their daughters over that of their dams immediately follows their name.

The leading native bulls are, omitting those which have not at least two daughter-dam pairs:

Hood Farm Pogis 9th	(50)	+0.243	Significant
Hood Farm Torono	(142)	—0.225	Probably significant
Spermfield Owl	(98)	+0.027	Not significant
Loretta's King	(178)	—0.430	Significant
Sayda's Heir 3d	(65)	+0.166	Not significant
Hector Marigold	(9)	+0.617	Probably not significant
Irene's King Pogis	(8)	+0.650	Significant
Lady Letty's Victor	(77)	+0.134	Not significant

The leading imported bulls are, omitting those with less than two daughter-dam pairs:

Interested Prince	(102)	—0.012	Not significant
Raleigh's Fairy Boy	(212)	—0.714	Significant
Gamboge's Knight	(71)	+0.148	Not significant
Royal Majesty	(150)	—0.264	Not significant
Noble of Oaklands	(26)	+0.386	Not significant
Eminent's Raleigh	(224)	—1.165	Probably not significant
The Imported Jap	(43)	+0.269	Probably not significant
Gedney Farm Oxford Lad	(109)	—0.071	Not significant

In the list of native bulls the one transmitting the highest butter-fat percentage to his progeny was Irene's King Pogis with 0.650 as his daughter-dam difference. The lowest bull was Loretta's King reducing the butter-fat test of his progeny over that of their dams 0.430 per cent. The bull transmitting the highest butter-fat percentage to his offspring for the imported sires was Noble of Oaklands with 0.386 to his credit. The bull which decreased his daughter's butter-fat percentage most was Eminent's Raleigh with a decrease of 1.165 per cent.

In the native bull group six bulls increased the butter-fat percentage of their daughters. Of this number two sires significantly increased the butter-fat percentage of their daughters, one increased it but probably not significantly and three increased it but the increase was not significant. Of those sires who decreased the butter-fat percentage of their daughters one significantly and another probably significantly decreased it. In the imported bull group three increased and five decreased the butter-fat percentage. Of those sires which increased the butter-fat percentage not one increased it by an amount of more than doubtful significance. Three sires not signicantly, one sire probably not significantly and one sire significantly lowered the butter-fat percentage. The native bulls were clearly superior to the imported bulls in their abilities to transmit high butter-fat percentage.

The outstanding bull of these two lists as far as concerns the number of daughter-dam pairs and the amount he raised the butter-fat percentage of his daughters is Irene's King Pogis. The pedigree of this bull is shown below.

Pedigree of Irene's King Pogis 73182.

<table>
<tr><td rowspan="16">Maine Agr. Exp. Sta.—Setndard Pedigree Blank
Sheet No.
Sex
No. 73182
Irene's King Pogis
No. 146443
Jacoba Irene</td><td rowspan="8">♂
No. 65790
Rosette's Golden King</td><td rowspan="4">No. 57498 ♂
Rosette's Golden Lad</td><td rowspan="2">No. P. S. 2535 ♂
Orlando</td><td>No. 2023 ♂
S. Golden Lad 2nd</td></tr>
<tr><td>No. 4915 ♀
D. White Rose</td></tr>
<tr><td rowspan="2">No. 149740 ♀
Sultana's Rosette</td><td>No. P. S. 797 ♂
Sarabond</td></tr>
<tr><td>No. P. S. 2128 ♀
Rosetto 4th</td></tr>
<tr><td rowspan="4">No. 100356 ♀
Diploma's Bird</td><td rowspan="2">No. 26574 ♂
Snob</td><td>No. 16219 ♂
Diploma</td></tr>
<tr><td>No. 16582 ♀
Clara's Belle</td></tr>
<tr><td rowspan="2">No. 71546 ♀
Chatterbox</td><td>No. 23110 ♂
Lexicon</td></tr>
<tr><td>No. 65551 ♀
Chirp</td></tr>
<tr><td rowspan="8">♀</td><td rowspan="4">No. 50110 ♂
King of Corfu</td><td rowspan="2">No. 37523 ♂
Matilda's Duke</td><td>No. 19169 ♂
Ida of St. Lambert's Bull</td></tr>
<tr><td>No. 75348 ♀
Matilda's Matilda</td></tr>
<tr><td rowspan="2">No. 83731 ♀
Belle of Corfu</td><td>No. 23689 ♂
St. Lambert Perrot</td></tr>
<tr><td>No. 59992 ♀
Tuda St. Lambert</td></tr>
<tr><td rowspan="4">No. 146435 ♀
Pogis Irene 2nd</td><td rowspan="2">No. 38979 ♂
Gretchen's Prince</td><td>No. 18208 ♂
Turbigo</td></tr>
<tr><td>No. 46325 ♀
Gretchen of Pevely</td></tr>
<tr><td rowspan="2">No. 88922 ♀
Pogis Irene</td><td>No. 18215 ♂
Charity's Stoke Pogis</td></tr>
<tr><td>No. 80712 ♀
Ethol's Irene</td></tr>
</table>

The pedigree of this bull has much of the St. Lambert strain on the mother's side. No inbreeding has taken place up to the fifth generation. Several animals of much merit are seen throughout the pedigree. The wonder is not that he caused his daughters to produce so high a butter-fat concentration in their milk as compared with their dams, but that he did not cause these same daughters to produce a larger quantity of milk.

Another class of bulls should not be passed by without mention. These are the bulls which raised the quantity of the milk produced by the daughters over that of their dams and also raised the butter-fat percentage of this milk. The facts for this may be extracted from the two tables 4 and 5. Signal's Successor and Golden Glow's Chief are the leading bulls in this set. Such bulls as these certainly improve the breed. Bulls of the opposite class are those which decrease both the quantity and quality of their daughters' milk. These two kinds of

bulls will be the subjects of special study in a succeeding section of this paper.

THE TRANSMITTING QUALITIES OF JERSEY SIRES FOR NET BUTTER-FAT.

The quantity of butter-fat produced is a function of the two variables, amount of milk and percentage of fat in the milk. Since this is so, the heading of the section could with equal propriety be the net change in the butter-fat from mother to daughter of the daughters of Jersey sires.

The arrangement of the table to show this relation for Jersey sires differs from the preceding tables in that the column for the quartiles is omitted as being superfluous since these data have been given in tables 4 and 5 for the two variables on which the amount of butter-fat depends. The first column of table 6 gives the place occupied by the bull in the series of bulls. The second and third columns give the name and registry number of the bull. The fourth column states how many pairs of daughter-dam tests the bull under discussion had. The fifth column gives the number of pounds of butter-fat that the bull's daughters are in excess or defect of their dams. It is by this column that the bulls are arranged, the bull whose daughters produced the most butter-fat over the butter-fat production of their dams coming at the top of the list. The plus sign shows the daughters produced more butter-fat than their dams, the minus sign that they produced less butter-fat.

TABLE 6.

Bulls in Order of Change in Net Fat of Daughters.

No.	Name of Bulls	Registry No.	No. of Pairs	Net Change
1	Sans Aloi	81012	2	+210.56 lbs.
2	Signal's Successor	72758	3	+177.72 lbs.
3	Golden Glow's Chief	61460	4	+161.93 lbs.
4	Hood Farm Pogis 34th	63300	2	+159.24 lbs.
5	Tormentor's Landseer Signal	69291	4	+153.55 lbs.
6	Clear Brook Chief	74685	2	+153.31 lbs.
7	Channel King	62762	2	+150.30 lbs.
8	Golden Nero	62052	2	+149.77 lbs.
9	Majestic Fern	84428	3	+143.97 lbs.
10	Roma's Rioter of St. L.	70951	3	+143.79 lbs.
11	You'll Do Oxford	98772	2	+136.61 lbs.

Bulls in Order of Change in Net Fat of Daughters—Continued.

No.	Name of Bulls	Registry No.	No. of Pairs	Net Change
12	Hood Farm Figgis Torono	90517	3	+132.50 lbs.
13	Temisia's Interested Prince	71648	2	+131.12 lbs.
14	Rinda Lad of S. B.	89518	2	+126.38 lbs.
15	The Plymouth Lad	89792	4	+123.55 lbs.
16	Hood Farm Torono	60326	34	+121.51 lbs.
17	Agatha's Brookhill Fox	69633	2	+115.40 lbs.
18	Fontaine's King	65641	2	+111.60 lbs.
19	Golden Fern's Son	78687	9	+109.32 lbs.
20	Baronetti's Golden Lad	67908	2	+100.14 lbs.
21	Spermfield Owl	57088	26	+ 97.71 lbs.
22	Sultan of Oaklands	78475	3	+ 95.06 lbs.
23	Melia Ann's King 9th	74917	2	+ 93.48 lbs.
24	Chenille's Golden Prince	91769	2	+ 93.06 lbs.
25	Eurybia's Blue Boy	90591	3	+ 90.17 lbs.
26	Forfarshire's King Dalton	95339	7	+ 88.00 lbs.
27	Rioter's Jersey Lad	58001	7	+ 87.10 lbs.
28	Queen's Raleigh	88232	3	+ 82.68 lbs.
29	Pogis 99th of Hood Farm	94502	14	+ 82.34 lbs.
30	Royal Majesty	79313	5	+ 81.34 lbs.
31	Jenny's Redfern	70388	2	+ 79.56 lbs.
32	Rearguard	70962	2	+ 79.24 lbs.
33	Oxford's Fairy Boy	92821	3	+ 77.14 lbs.
34	Gertie's Stoke Pogis	56492	3	+ 70.59 lbs.
35	Mabel's Raleigh	P.S. 3722 H.C.	3	+ 70.51 lbs.
36	Pogis 66th of Hood Farm	85015	3	+ 66.86 lbs.
37	My Jubilee	75742	2	+ 66.75 lbs.
38	Oxford Lass's Cream King	81359	3	+ 66.23 lbs.
39	Great Edison	77564	2	+ 62.78 lbs.
40	The Warden's Sir Prince	89421	2	+ 60.87 lbs.
41	Nova Boy of Turner	72135	2	+ 58.82 lbs.
42	Nebraska Lad	71828	2	+ 57.14 lbs.
43	Hood Farm Golden Lad	64268	5	+ 56.50 lbs.
44	Spermfield Owl 2d	93634	2	+ 51.85 lbs.
45	Marston's Interested Prince	71855	9	+ 51.82 lbs.
46	Eminent's Tormentor	85936	2	+ 51.81 lbs.
47	Chief Engineer	47148	6	+ 50.20 lbs.
48	Hood Farm Pogis 9th	55552	39	+ 47.49 lbs.
49	The Owl's Double Grandson	80314	5	+ 47.45 lbs.
50	Atwell Farm Melia Ann's King	97392	2	+ 45.85 lbs.
51	Dorinda Darling's Diploma	71816	6	+ 41.77 lbs.
52	Golden Shylock	81862	5	+ 41.00 lbs.
53	Loretta D's Champion's Son	77002	5	+ 38.66 lbs.
54	Taurus Perfection	80132	2	+ 38.56 lbs.
55	Brown Bessie's Columbus	68364	3	+ 38.18 lbs.
56	Blue Belle's Gold Fern	79043	3	+ 37.08 lbs.
57	Golden Lad of Glenwood Farm	62057	3	+ 35.08 lbs.
58	Tormentor Summit Lad	68620	4	+ 34.39 lbs.
59	Melia Ann's Hero 4th	84061	3	+ 33.50 lbs.
60	Keepsake's Golden Lad	71325	5	+ 32.18 lbs.
61	Bessie Bate's Lad	78296	2	+ 30.80 lbs.
62	Nutley Tones Owl	67837	3	+ 30.55 lbs.
63	Flying Fox's Oxford Duke 2d	76316	2	+ 29.30 lbs.
64	Lady Letty 4th's Rioter	76533	2	+ 28.33 lbs.
65	Golden Lad of Summit	85396	6	+ 27.79 lbs.
66	Golden Alcazar	72800	3	+ 27.32 lbs.
67	Foxhall's Jubilee	76944	10	+ 26.64 lbs.
68	Eminent's Pilot	75364	3	+ 24.18 lbs.
69	The Owl of Meridale	85853	5	+ 24.17 lbs.
70	G. G. Chief of Ashburn	86044	3	+ 23.75 lbs.
71	Imp. Rozel's Noble	96627	2	+ 22.76 lbs.
72	Eminent 4th	76078	5	+ 21.54 lbs.
73	Interested Prince	58224	21	+ 21.07 lbs.
74	Pogis 75th of Hood Farm	94501	7	+ 21.00 lbs.
75	Sayda's Heir 3d	74817	15	+ 20.87 lbs.
76	Eminent of Acca Farm	84617	3	+ 20.39 lbs.
77	St. Oner's Torono	81219	2	+ 20.32 lbs.
78	Flying Fox's Victor	64768	2	+ 18.58 lbs.
79	St. Lambert's Ridgewood King	73247	2	+ 16.32 lbs.
80	Loretta's King	65050	18	+ 15.94 lbs.
81	Romulus of Spring Hill	78837	4	+ 13.34 lbs.

Bulls in Order of Change in Net Fat of Daughters—Continued.

No.	Name of Bulls	Registry No.	No. of Pairs	Net Change
82	Cream Princess' Fritz	65915	2	+ 12.57 lbs.
83	Irene's King Pogis	73182	16	+ 12.31 lbs.
84	Anderson's King	75247	2	+ 11.11 lbs.
85	Storrs Golden Lad	68189	2	+ 9.80 lbs.
86	The Warden	77015	12	+ 8.47 lbs.
87	Lord Letta of Meridale	55716	2	+ 7.89 lbs.
88	Eva's Grey Fox	72444	2	+ 7.67 lbs.
89	Oonan's Count	57470	8	+ 7.55 lbs.
90	Valentines Qonan	58076	10	+ 5.19 lbs.
91	Marigold St. Helier	52657	4	+ 4.42 lbs.
92	Noble of Oaklands	95700	3	+ 4.24 lbs.
93	Fairfield's Chancellor	74363	2	+ 3.51 lbs.
94	Exile of the Highlands	81869	4	+ 3.23 lbs.
95	Foxy's Brown Poet	82982	7	+ 2.54 lbs.
96	Nimbus of Brondale	69704	3	+ 1.59 lbs.
97	Gedney Farm Oxford Lad	71238	2	+ 1.57 lbs.
98	Foxy's Fox of Althea	77197	2	+ 1.52 lbs.
99	Golden Butter Lad	77164	2	+ 1.25 lbs.
100	Pedro's Vidi	71235	2	— 0.51 lbs.
101	Mabel's Raleigh	77913	3	— 1.46 lbs.
102	Merry Maiden's Grandson	71003	6	— 3.27 lbs.
103	Model's Oxford Lad	66518	5	— 6.99 lbs.
104	Lookout Torono	78593	17	— 7.94 lbs.
105	Hood Farm Golden Lad 4th	71215	3	— 8.37 lbs.
106	Hazel Fern Golden King	77872	8	— 8.74 lbs.
107	Eurybia's Son	68790	3	— 9.94 lbs.
108	Rosetta's Golden Lad	73203	5	— 10.04 lbs.
109	Pogis of Goliad	84397	3	— 12.48 lbs.
110	White Oak Monarch	88433	3	— 12.64 lbs.
111	Prince Noel	74140	4	— 13.04 lbs.
112	Mr. Inez Marigold Pedro	79701	3	— 13.49 lbs.
113	Tonona Pogis	78657	14	— 14.00 lbs.
114	Fontaine's Caiest	81118	5	— 15.01 lbs.
115	Imp. Noble Fontaine Raleigh	91142	5	— 15.04 lbs.
116	Lady Letty's Victor	65020	15	— 15.70 lbs.
117	Guenon's Lad 2d	62304	2	— 15.80 lbs.
118	Oxford's Brigadier	78529	2	— 17.48 lbs.
119	Cinxia's Gamboge Lad	90848	3	— 17.69 lbs.
120	Portland Prospect	61919	3	— 18.98 lbs.
121	Gamboge's Knight	95698	5	— 20.07 lbs.
122	Oxford Daisy's Flying Fox	83284	6	— 20.38 lbs.
123	Hood Farm Torono 21st	83413	4	— 20.85 lbs.
124	Copper Baron	64453	2	— 21.24 lbs.
125	Karnak's Noble	87952	4	— 21.25 lbs.
126	Jersey Lad's Caspar	71077	5	— 21.69 lbs.
127	Marigold's Exile King	53232	8	— 22.37 lbs.
128	Nero's Garfield Lad	77949	2	— 22.72 lbs.
129	Alcarano	69653	4	— 23.69 lbs.
130	Oonan's Major	91036	2	— 25.33 lbs.
131	Merry Miss' Son	76629	5	— 26.17 lbs.
132	Meridale Interested Prince	86473	6	— 26.55 lbs.
133	Oonan's Conqueror	77851	2	— 27.48 lbs.
134	Fontaine's Lodestar	77305	4	— 27.56 lbs.
135	Seven Gates	75925	5	— 29.25 lbs.
136	Noble's Jolly Golden Lad	104562	2	— 29.78 lbs.
137	Naiad's Golden Lad	67475	3	— 31.57 lbs.
138	Romeo of Sheomet	62715	4	— 31.75 lbs.
139	Willson's Exile	44065	2	— 33.00 lbs.
140	Lad's Oxfordshire	74564	2	— 33.39 lbs.
141	Mabel's Poet	65780	5	— 36.33 lbs.
142	Eminent's Raleigh	69011	2	— 37.30 lbs.
143	Reservation Stoke Pogis	76048	5	— 37.98 lbs.
144	Fairy Glen's Raleigh	79438	5	— 38.32 lbs.
145	Gertrude's Jap	93947	2	— 38.47 lbs.
146	Rosaire's Olga Lad	87498	13	— 38.93 lbs.
147	Pogis 95th of Hood Farm	92626	5	— 39.71 lbs.
148	Prince Ramaposa	87833	2	— 39.83 lbs.
149	Valentine's Count	69878	6	— 40.75 lbs.
150	Sultana's Oxford Lad	76506	3	— 40.77 lbs.
151	Melia Ann's Berkshire	66373	2	— 42.39 lbs.

Bulls in Order of Change in Net Fat of Daughters—Concluded.

No.	Name of Bulls	Registry No.	No. of Pairs	Net Change
152	Glory's Pedro	95123	2	— 42.85 lbs.
153	Oxford King of Fernwood	81379	3	— 44.37 lbs.
154	Gertie's Son's Jamont	73745	2	— 45.00 lbs.
155	Pogis Alden Boy	96014	2	— 45.04 lbs.
156	King Allie Rioter	62221	2	— 45.11 lbs.
157	Hood Farm Torono 20th	82854	19	— 45.59 lbs.
158	Olga Hazel Pogis	95042	2	— 46.97 lbs.
159	Marigold's Champion	70801	3	— 47.12 lbs.
160	Sensational Fern	75924	3	— 47.58 lbs.
161	Imp. King of Hambie	65298	2	— 48.02 lbs.
162	Rosaire's Lad of Glenwood	76580	2	— 48.79 lbs.
163	Owl's Model Fox	76617	2	— 49.41 lbs.
164	Rochette's Noble	96422	2	— 49.84 lbs.
165	Biltmore's Torment	60761	4	— 50.61 lbs.
166	Gedney Farm Girl's Oxford	75998	14	— 53.27 lbs.
167	Mistletoe Pogis	75371	2	— 53.30 lbs.
168	Altama's Pogis	77089	3	— 53.31 lbs.
169	Raleigh's Fairy Boy	83767	10	— 53.67 lbs.
170	Quintin Owl	77041	3	— 56.07 lbs.
171	Altama Interest	98466	4	— 59.39 lbs.
172	Golden Lucy's Eminent Lad	85639	7	— 60.09 lbs.
173	Eminent 10th	75753	9	— 60.15 lbs.
174	The Imported Jap	75265	11	— 61.91 lbs.
175	Gamboge's Oxford Lad	67284	2	— 64.25 lbs.
176	Roving Gipsy	67588	2	— 64.75 lbs.
177	Golden Laddie of C.	67925	3	— 65.75 lbs.
178	Lord North	75342	2	— 65.98 lbs.
179	Inez's Stoke Pogis	51942	4	— 66.65 lbs.
180	Golden Paul	68919	3	— 68.05 lbs.
181	Oxford John D.	90048	3	— 68.26 lbs.
182	Ben Hur Pogis	38370	2	— 68.79 lbs.
183	Island Lodestar	67638	6	— 70.89 lbs.
184	Daisy's Prince of St. L.	75437	2	— 73.38 lbs.
185	Pogis 94th of Hood Farm	90492	2	— 75.91 lbs.
186	Amy's Chief	74154	4	— 76.37 lbs.
187	Fontaine's Duke	61709	6	— 76.54 lbs.
188	St. Mawes	72053	2	— 78.44 lbs.
189	Fontaine's Count	84083	2	— 80.51 lbs.
190	Pedro of Brick House Farm	88867	3	— 82.31 lbs.
191	Jacoba's Emanon	84177	9	— 84.27 lbs.
192	Fad	85670	2	— 85.61 lbs.
193	Cowslip's Ashley	83633	3	— 87.42 lbs.
194	Benedictine King	86100	2	— 88.14 lbs.
195	H. F. Golden Fern's Lad	80437	7	— 90.49 lbs.
196	Tormentor's Torono	78184	5	— 90.51 lbs.
197	Girldine's Champion Pogis	94004	3	— 90.60 lbs.
198	King's Rioter Lawrence	65453	2	— 94.96 lbs.
199	Gazelle's Fawn Rioter King	71966	3	— 98.85 lbs.
200	Noble Peer	90653	4	— 98.85 lbs.
201	Violet's Oakland Count	80974	2	— 99.71 lbs.
202	Minaret Exile	56933	9	—100.59 lbs.
203	Brown Lassie's Compass	71626	5	—100.61 lbs.
204	Fort Hill Farm Torono	72940	2	—102.25 lbs.
205	Viola's Golden Jolly	79314	2	—102.51 lbs.
206	Oaklands Sultan King	85602	2	—103.95 lbs.
207	Gertie's Son's Boy	71825	2	—106.18 lbs.
208	Adelaide's Merry Pogis	91365	3	—108.14 lbs.
209	Mona Rose's Glory	92531	5	—110.94 lbs.
210	Financial Raleigh	86298	4	—115.05 lbs.
211	Jacoba's Premier	89296	3	—115.10 lbs.
212	Margery Golden's Fox	72362	4	—119.76 lbs.
213	Fern's Air	77589	2	—123.55 lbs.
214	Harry B. Gordon	47246	2	—124.46 lbs.
215	Combination Golden Lad	59292	3	—138.06 lbs.
216	Hector Marigold	59121	2	—144.12 lbs.
217	Lady Mary's Fox	82763	2	—148.02 lbs.
218	Rosaire's Golden Lad	64554	2	—149.95 lbs.
219	St. Helier of Sheomet	61765	3	—150.59 lbs.
220	Oonan 23d's Grandson	74887	3	—156.92 lbs.
221	Jubilee of Bois d'Arc	29041	3	—162.92 lbs.
222	Oxford Lad's Owl	75599	2	—164.84 lbs.
223	Hood Farm S. Tormentor	76311	3	—219.72 lbs.
224	Gertie's Son of Washington	83799	3	—227.01 lbs.

The bulls of superior merit, although they have only a few pairs on which to base judgment, are Sans Aloi, Signal's Successor and Golden Glow's Chief, with 210.56, 177.72, and 161.93 pounds of butter-fat by which their daughters were superior to their respective dams. Discussion of these bulls is perhaps needless since they are familiar to most breeders as of outstanding merit. It is of interest to see the pedigree of Golden Glow's chief as he has the honor of being sire of the justly famous cow Vive la France. This pedigree is presented below.

PEDIGREE OF GOLDEN GLOW'S CHIEF 61460.

Maine Agr. Exp. Sta.—Standard Pedigree Blank

Sheet No.

Sex ♂

No. 6460 Golden Glow's Chief

No. 129238 Golden Glow

No. 47148 Chief Engineer

No. 39344 ♂ Brown Bessie's Diploma	No. 34550 ♂ Brown Bessie's Son	No. 17576 ♂ Combination 3d
		No. 74997 ♀ Brown Bessie
	No. 80796 ♀ Sombre	No. 16219 ♂ Diploma
		No. 64924 ♀ Alexa
No. 88038 ♀ Sulphide	No. 16159 ♂ Prince of Mahaska	No. 10664 ♂ Elevator
		No. 27403 ♀ Zerelda
	No. 29637 ♀ Crusta	No. 4389 ♂ Combination
		No. 23245 ♀ Exhibit
No. P. S. 2052 ♂ Reminder	No. P. S. 1769 ♂ Nunthorpe	No. P. S. 1242 ♂ Golden Lad
		No. P. S. 3880 ♀ Alicante
	No. P. S. 4856 ♀ Flyaway	No. P. S. 1242 ♂ Golden Lad
		No. P. S. 1145 ♀ Sultanne 9th
No. P. S. 1281 ♀ Lady Jane Grey 2nd	No. P. S. 242 ♂ Garibaldi	No. P. S. 187 ♂ Pretender
		No. P. S. 1838 ♀ Lady Alice
	No. F. S. 3437 ♀ Lady Jane Grey	No. ♂
		No. ♀

This bull is shown by his pedigree to be a combination of American breeding on his sire's side and of Island breeding on his mother's side. It will be noted that on the dam's side a repetition of Golden Lad takes place in the fourth generation.

We may now take up the list of leading native and imported sires for the net change in the butter-fat by which their daughters on the average are different from their dams. The

list of these bulls together with the number of the bull in the series of bulls in table 6 and the net change of butter-fat by which their daughters were in excess or defect of their dams is given below.

List of leading native sires, omitting those who have not two daughter-dam pairs, are:

Hood Farm Pogis 9th	(48)	+ 49.49	Significant
Hood Farm Torono	(16)	+121.51	Significant
Spermfield Owl	(21)	+ 97.71	Significant
Loretta's King	(80)	+ 15.94	Not significant
Sayda's Heir 3d	(75)	+ 20.87	Not significant
Hector Marigold	(216)	—144.12	Significant
Irene's King Pogis	(83)	+ 12.31	Not significant
Lady Letty's Victor	(116)	— 15.70	Not significant

Leading imported sires, omitting those which have not two daughter-dam pairs, are:

Interested Prince	(73)	+ 21.07	Not significant
Raleigh's Fairy Boy	(169)	— 53.67	Not significant
Gamboge's Knight	(121)	— 20.07	Not significant
Royal Majesty	(30)	+ 81.34	Probably significant
Noble of Oaklands	(92)	+ 4.24	Not significant
Eminent's Raleigh	(142)	— 37.30	Not significant
The Imported Jap	(174)	— 61.91	Probably not significant
Gedney Farm Oxford Lad	(97)	+ 1.57	Not significant

In the list of native sires six increase the production of their daughters and two decrease it. Within this group of six sires which increased the butter-fat, three did so by an amount which was significant and three by an amount which was not significant. One sire which decreased the butter-fat yield of his daughters did it by an amount which was not significant. The other sire, Hector's Marigold, decreased the yield of his daughters significantly. In the list of imported sires four increase and four decrease the production of butter-fat of their daughters over that of their dams. Of the four imported sires which increase the butter-fat yield only one, Royal Majesty increased it by an amount great enough to be probably significant. Within the group of sires which decreased the butter-fat of their daughters none decreased it significantly. This particular group of native sires is consequently superior to the imported

sire in respect to their butter-fat transmitting qualities. This conclusion need not necessarily hold for another group of sires, for if one thing is clearly brought out by this progeny study on Jersey sires it is the fact that the inherited complex which a bull is able to give to his daughters is an individual proposition and requires individual study rather than any mass study.

Considering the number of daughters two bulls stand forth among the rest as of superior merit, Hood Farm Torono and Spermfield Owl. The pedigree of Hood Farm Torono has already been given. The Pedigree of Spermfield Owl is presented below.

PEDIGREE OF SPERMFIELD OWL, 57088.

Maine Agr. Exp. Sta.—Standard Pedigree Blank

Sheet No.	Sex							
No. 57088 Spermfield Owl	♂	N. P. S. 2195 The Owl	No. P. S. 1690 ♂ Marion		No. P. S. 1242 ♂ Golden Lad		No. P. S. 873 ♂ Sultanne's Favourite	
							No. P. S. 2447 ♀ Golden Lass 4th	
					No. P. S. 3056 ♀ Cicero's Cowslip 3d		No. P. S. 873 ♂ Sultanne's Favourite	
							No. P. S. 1105 ♀ Cicero's Cowslip	
			No. P. S. 3880 ♀ Alicante		No. P. S. 928 ♂ County Wolseley		No. P. S. 401 ♂ Wolseley	
							No. P. S. 7 ♀ Sultanne	
					No. P. S. 2881 ♀ Rosette 5th		No. P. S. 797 ♂ Sarabond	
							No. P. S. 2128 ♀ Rosette 4th	
	♀	No. P. S. 5089 Spermfield Lassie	No. P. S. 1547 ♂ Sir Julius		No. P. S. 997 ♂ Useful Lady		No. P. S. 743 ♂ Paragon	
							No. P. S. 796 ♀ Lady Useful	
					No. F. S. 7475 ♀ Cellina		No. ♂	
							No. ♀	
			No. P. S. 4157 ♀ Spermlight		No. P. S. 1118 ♂ Windemere's Glory		No. P. S. 801 ♂ Stafford	
							No. P. S. 1784 ♀ Cicero's Duchess	
					No. F. S. 6645 ♀ Spermlight		No. ♂	
							No. ♀	

Spermfield Owl's pedigree shows that he is by a bull and from a cow which were imported to this country. The benefit to the dairy interests of the Jersey breed, as shown by the performance of this bull in his progeny test, certainly more than justifies the importation of these two animals.

The sire's side of Spermfield Owl's pedigree runs quickly into the justly famous Golden Lad and Rosette strains. In fact the Owl is an inbred Sultanne's Favorite bull. The dam's side of the pedigree goes into foundation stock rather quickly.

TRANSMITTING QUALITIES OF JERSEY SIRES TO THEIR SONS.

In this section we deal with the sire whose sons' transmitting qualities for quantity and quality of milk production are known through the progeny tests of their daughters. For this purpose table 7 has been made. The arrangement of this table is made on the basis of how much butter-fat the sire's son or sons caused his daughters to produce in excess or defect of their dams. The mean of each item is taken for each sire's son if he has more than one son of known transmitting powers. The information given in this table is as follows: (1) The number which the sire takes in the series of sires, on the butter-fat transmitting qualities of his sons is given in the first column; (2) the sire's name is given; (3) immediately under the sire's name is given the sons' names each one of which is indented; (4) beside each bull's name is given his registry number, the number of daughter-dam pairs that he has, the net change in the milk production which his daughters produced in comparison with that of their dams, the net change in the butter-fat percentage and the net change in the butter-fat.

TABLE 7.

Sires in Order of Sons' Change in Net Butter-Fat.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
1	Signal's Crown Prince	61621	--	--	--	--
	Signal's Successor	72758	3	+2899.3	+0.202	+177.72
2	Chief Engineer	47148	6	+2174.5	—0.684	+ 50.20
	Golden Glow's Chief	61460	4	+2172.4	+0.453	+161.93
	Clear Brook Chief	74685	2	+ 278.0	+1.338	+153.31
	Mean			+1225.2	+0.895	+157.62
3	Tormentor's Tormentor	52074	--	--	--	--
	Tormentor's Landseer Signal	69291	4	+2326.7	+0.292	+153.55
4	Golden Blyth	49215	--	--	--	--
	Golden Nero	62052	2	+3369.0	—0.543	+149.77
5	Royal Majesty	79313	5	+2138.6	—0.264	+ 81.34
	Majestic Fern	84428	3	+2163.3	+0.123	+143.97
6	Lucy's Rioter of St. L.	63998	--	--	--	--
	Roma's Rioter of St. L.	70951	3	+2534.7	—0.081	+143.79

Sires in Order of Sons' Change in Net Butter-Fat—Continued.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
7	Imported Oxford You'll Do	111860	--	--	--	--
	You'll Do Oxford	98772	2	+2797.0	—0.254	+136.61
8	Gertie's Lad	70050	--	--	--	--
	Rinda Lad of S. B.	89518	2	+3403.5	—0.802	+126.38
9	Fabby's Shylock	70334	--	--	--	--
	Sans Aloi	81012	2	+4464.5	—0.398	+210.56
	Golden Shylock	81862	5	+ 871.8	—0.086	+ 41.00
	Mean			+2668.1	—0.242	+125.78
10	Flower's Hero	P.S. 3502 C.	--	--	--	--
	The Plymouth Lad	89792	4	+2810.3	—0.281	+123.55
11	Torono	25204	4	--	+0.176	--
	Hood Farm Torono	60326	34	+2620.1	—0.225	+121.51
12	Hood Farm Pogis	40684	--	--	--	--
	Hood Farm Pogis 34th	63390	2	+2528.0	+0.044	+159.24
	Hood Farm Pogis 9th	55552	39	+ 448.9	+0.243	+ 47.49
	Mean			+1488.5	+0.143	+103.37
13	Rosette's Golden Lad	57498	--	--	--	--
	Baronetti's Golden Lad	67908	2	+1924.5	—0.081	+100.14
14	Golden Rachel's Prince	60386	--	--	--	--
	Chenille's Golden Prince	91769	2	+1242.0	+0.264	+ 93.06
15	Forfarshire's Rex	62957	--	--	--	--
	Forfarshire's King Dalton	95339	7	+2064.6	—0.266	+ 88.00
16	Ida's Rioter of St. L. 11th.	41012	--	--	--	--
	Rioter's Jersey Lad	58001	7	+1415.2	+0.019	+ 87.10
17	Financial King	57788	--	--	--	--
	Fontaine's King	65641	2	+2678.5	—0.352	+111.60
	Hood Farm Golden Lad	64268	5	+1357.2	—0.167	+ 56.50
	Mean			+2017.9	—0.259	+ 84.05
18	Fairy Glen's Raleigh	79438	5	— 191.8	—0.291	— 38.32
	Queen's Raleigh	88232	3	+4545.7	—1.199	+ 82.68
19	Lily's King	62195	--	--	--	--
	Rearguard	70962	2	+1992.5	—0.230	+ 79.24
20	Raleigh's Fairy Boy	83767	10	+ 453.8	—0.714	— 53.67
	Oxford's Fairy Boy	92821	3	+1772.0	—0.249	+ 77.14
21	Stoke Pogis of Prospect	29121	--	--	--	--
	Channel King	62762	2	+2332.0	+0.148	+150.30
	Gertie's Stoke Pogis	56492	3	+1688.3	—0.196	+ 70.59
	Portland Prospect	61919	3	— 858.7	+0.236	— 18.98
	Mean			+1053.9	+0.063	+ 67.30
22	Jubilee of Bois d'Arc	29041	3	—1542.3	—0.810	—162.92
	My Jubilee	75742	2	+1646.5	—0.128	+ 66.75
23	Lucy's Oxford Lad	69637	--	--	--	--
	Oxford Lass's Cream King	81359	3	+1386.0	—0.105	+ 66.23
24	Agatha's Flying Fox	68212	--	--	--	--
	Agatha's Brookhill Fox	69633	2	+2957.5	—0.588	+115.40
	Sultan of Oaklands	78475	3	+1104.7	+0.385	+ 95.06
	Gamboge's Knight	95698	5	— 610.6	+0.148	— 20.07
	Mean			+1150.5	—0.018	+ 63.46
25	Melia Ann 3d's Grandson	71698	--	--	--	--
	Great Edison	77564	2	— 507.5	+1.022	+ 62.78
26	The Warden	77015	12	+1189.6	—0.732	+ 8.47
	The Warden's Sir Prince	89421	2	+1498.5	—0.186	+ 60.87
27	Golden Duchess' Prince	62803	--	--	--	--
	Nebraska Lad	71828	2	+ 296.5	+0.439	+ 57.14
28	Interested Prince	58224	21	+ 401.8	—0.012	+ 21.07
	Temisia's Interested Prince	71648	2	+3686.5	—0.804	+131.12
	Marston's Interested Prince	71855	9	+1764.8	—0.508	+ 51.82
	Meridale Interested Prince	86473	6	— 438.4	—0.014	— 26.55
	Mean			+1671.0	—0.442	+ 52.13
29	Eminent's Silver Boy	73078	--	--	--	--
	Eminent's Tormentor	85936	2	+1662.5	—0.544	+ 51.81
30	Brown Bessie's Diploma	39344	--	--	--	--
	Chief Engineer	47148	6	+2174.5	—0.684	+ 50.20
31	Fontaine's Duke	61709	6	— 861.7	—0.275	— 76.54
	The Owl's Double Grandson	80314	5	+2015.2	—0.492	+ 47.45
32	Loretta D's Champion	72983	--	--	--	--
	Loretta D's Champion's Son	77002	5	— 16.2	+0.441	+ 38.66
33	Golden Toro	58265	--	--	--	--
	Taurus Perfection	80132	2	+170.55	—0.622	+ 38.56

Sires in Order of Sons' Change in Net Butter-Fat—Continued.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
34	Recorder	29239	--	--	--	--
	Brown Bessie's Columbus	68364	3	+ 992.3	—0.146	+ 38.18
35	Blue Bell's Golden Fern	69196	--	--	--	--
	Blue Bell's Gold Fern	79043	3	+ 429.4	+0.139	+ 37.08
36	Spermfield Owl	57088	26	+1695.7	+0.027	+ 97.71
	Spermfield Owl 2d	93634	2	+1653.5	+0.482	+ 51.85
	Nutley Tones Owl	67853	3	+ 259.0	+0.174	+ 30.55
	The Owl of Meridale	85853	5	+ 66.2	+0.218	+ 24.17
	Mean			+ 659.6	—0.030	+ 35.52
37	June Beauty's Lad	59154	--	--	--	--
	Tormentor Summit Lad	68620	4	+1244.3	—0.526	+ 34.39
38	Melia Ann's Hero	76537	--	--	--	--
	Melia Ann's Hero 4th	84061	3	+1208.3	—0.605	+ 33.50
39	Melia Ann's King	56581	--	--	--	--
	Melia Ann's King 9th	74917	2	+1734.5	—0.136	+ 93.48
	Atwell Farm Melia Ann's King	97392	2	— 625.5	+0.757	+ 45.85
	Melia Ann's Berkshire	66373	2	— 801.5	+0.035	— 42.39
	Mean			+ 102.5	+0.219	+ 32.31
40	Tulip's Mon Plaisir	61923	--	--	--	--
	Keepsake's Golden Lad	71325	5	+ 165.2	+0.244	+ 32.18
41	Fairy's Lad	68013	--	--	--	--
	Bessie Bate's Lad	78296	2	+ 649.5	—0.016	+ 30.80
42	Isabelle's Golden Lad	62833	--	--	--	--
	Golden Lad of Summit	85396	6	+1218.2	—0.495	+ 27.79
43	Arthur's Golden Marquis	61428	--	--	--	--
	Golden Alcazar	72800	3	— 231.3	+0.431	+ 27.32
44	Flying Fox's Foxhall	61435	--	--	--	--
	Foxhall's Jubilee	76944	10	+1109.1	—0.269	+ 26.64
45	Golden Glow's Chief	61460	4	+2172.4	+0.453	+161.93
	G. G. Chief of Ashburn	86044	3	+ 591.7	—0.122	+ 23.75
46	Eurybia's Combination	80438	--	--	--	--
	Eurybia's Blue Boy	90591	3	+1170.3	+0.253	+ 90.17
	Olga Hazel Pogis	95042	2	— 698.5	—0.094	— 46.97
	Mean			+ 235.9	+0.079	+ 21.60
47	Alexie	P.S. 2656 H. C.	--	--	--	--
	Interested Prince	58224	21	+ 401.8	—0.012	+ 21.07
48	Sayda's Heir	45360	--	--	--	--
	Sayda's Heir 3d	74817	15	+ 106.5	+0.166	+ 20.87
49	Merry Maiden's 3d Son	60516	--	--	--	--
	Dorinda Darling's Diploma	71816	6	+1042.9	—0.156	+ 41.77
	Merry Maiden's Grandson	71003	6	—1062.7	+0.560	— 3.27
	Mean			— 9.9	+0.202	+ 19.25
50	Lorna's King of St. L. King	57389	--	--	--	--
	Loretta's King	65050	18	+1000.2	—0.430	+ 15.94
51	Golden Romulus 2d	59876	--	--	--	--
	Romulus of Spring Hill	78837	4	+ 442.2	—0.160	+ 13.34
52	Gen Jamont 2d	58018	--	--	--	--
	Cream Princess' Fritz	65915	2	— 77.0	+0.155	+ 12.57
53	Rosette's Golden King	65790	--	--	--	--
	Irene's King Pogis	73182	16	— 761.8	+0.650	+ 12.31
54	King of St. Lambert's King Jr.	62140	--	--	--	--
	Anderson's King	75247	2	+1105.0	—0.658	+ 11.11
55	The Owl	54738	--	--	--	--
	Spermfield Owl	57088	26	+1695.7	+0.027	+ 97.71
	Fontaine's Duke	61709	6	— 861.7	—0.275	— 76.54
	Mean			+ 417.0	—0.124	+ 10.59
56	Imp. Golden Fern's Lad	65300	--	--	--	--
	Golden Fern's Son	78687	9	+1156.5	+0.458	+109.32
	Jenny's Redfern	70388	2	+1582.0	+0.030	+ 79.56
	Golden Butter Lad	77164	2	— 477.0	+0.433	+ 1.25
	Sensational Fern	75924	3	—1286.0	+0.275	— 47.58
	H. F. Golden Fern's Lad	80437	7	—1048.7	—0.361	— 90.49
	Mean			— 14.6	+0.167	+ 10.41
57	Westland Golden Lad	64329	--	--	--	--
	Storrs Golden Lad	68189	2	+ 33.0	+0.078	+ 9.80
58	Ida's Coquette Pogis	43044	--	--	--	--
	Lord Letta of Meridale	55716	2	+1065.0	—0.430	+ 7.89

Sires in Order of Sons' Change in Net Butter-Fat—Continued.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
59	Golden Fox	62166	--	--	--	--
	Eva's Grey Fox	72444	2	+1564.0	—0.731	+ 7.67
60	Oonan's Pogis 7th	47902	--	--	--	--
	Oonan's Count	57470	8	— 72.3	+0.150	+ 7.55
61	Rioter of St. Lambert Jr.	56580	--	--	--	--
	Lady Letty 4th's Rioter	76533	2	+1767.0	—0.684	+ 28.33
	Lady Letty's Victor	65020	15	— 534.5	+0.134	— 15.70
	Mean			+ 616.3	—0.275	+ 6.31
62	Sir Donald	39047	--	--	--	--
	Valentine's Oonan	58076	10	+ 23.0	+0.048	+ 5.19
63	Osprey	17385	--	--	--	--
	Marigold St. Helier	52657	4	— 152.0	+0.136	+ 4.42
64	Blue Belle's Blue Fox	69632	--	--	--	--
	Noble of Oaklands	95700	3	— 453.3	+0.386	+ 4.24
65	Silver Chancellor	63960	--	--	--	--
	Fairfield's Chancellor	74363	2	+1083.0	—0.654	+ 3.51
66	Willson's Exile	44065	2	+ 447.0	—0.656	— 33.00
	Exile of the Highlands	81869	4	+ 141.2	—0.058	+ 3.23
67	Hood Farm Pogis 34th	63300	2	+2528.0	+0.044	+159.24
	Nimbus of Brondale	69704	3	+ 775.3	—0.577	+ 1.59
68	My Fanny's Flying Fox	65454	--	--	--	--
	Foxy's Fox of Althea	77197	2	+ 129.0	—0.057	+ 1.52
69	Champion Flying Fox	61441	--	--	--	--
	Flying Fox's Victor	64768	2	— 57.0	+0.281	+ 18.58
	Gedney Farm Oxford Lad	71238	2	+ 128.0	—0.071	+ 1.57
	Oxford Daisy's Flying Fox	83284	6	+ 117.2	—0.244	— 20.38
	Mean			+ 62.7	—0.011	— 0.08
70	Pedro's Golden Blyth	64335	--	--	--	--
	Pedro's Vidi	71235	2	— 90.5	+0.056	— 0.51
71	Mabel's Poet	65780	5	— 161.6	—0.310	— 36.33
	Foxy's Brown Poet	82982	7	— 132.9	+0.118	+ 2.54
	Fontaine's Caicst	81118	5	— 142.8	—0.077	— 15.01
	Mean			— 137.9	+0.021	— 6.23
72	Hood Farm Golden Lad	64268	5	+1357.2	—0.167	+ 56.50
	Hood Farm Golden Lad 4th	71215	3	+ 939.6	—0.420	— 8.37
73	Imp. Sultane's Golden Fern	65304	--	--	--	--
	Hazel Fern Golden King	77872	8	+ 494.4	—0.394	—. 8.74
74	Island Lodestar	67638	6	— 350.4	—0.563	— 70.89
	The Warden	77015	12	+1189.6	—0.732	+ 8.47
	Fontaine's Lodestar	77305	4	+ 252.3	—0.468	— 27.56
	Mean			+ 720.9	—0.600	— 9.55
75	Signalia's Siberia	67227	--	--	--	--
	Eurybia's Son	68790	3	— 836.6	+0.405	— 9.94
76	Duke Rowena's Golden Lad	63571	--	--	--	--
	Rosetta's Golden Lad	73203	5	— 269.2	+0.060	— 10.04
77	Lookout Torono	78593	17	+ 324.7	—0.305	+ 7.94
	Pogis of Goliad	84397	3	— 293.0	+0.060	— 12.48
78	Melia Ann's King 9th	74917	2	+1734.5	—0.136	+ 93.48
	White Oak Monarch	88433	3	— 462.3	+0.168	— 12.64
79	Admiral Noel	53882	--	--	--	--
	Prince Noel	74140	4	— 8.8	—0.148	— 13.04
80	Eminent	69631	--	--	--	--
	Eminent's Pilot	75364	3	+2380.0	—1.107	+ 24.18
	Eminent 4th	76078	5	+ 237.8	+0.084	+ 21.54
	Eminent of Acca Farm	84617	3	+1518.4	—0.597	+ 20.39
	Eminent's Raleigh	69011	2	+1325.0	—1.165	— 37.30
	Imp. King of Hambie	65298	2	— 43.5	—0.599	— 48.02
	Eminent 10th	75753	9	— 599.0	—0.346	— 60.15
	Mean			+ 803.1	—0.622	— 13.23
81	Mr. W. Inez of Bleak House	70916	--	--	--	--
	Mr. Inez Marigold Pedro	79701	3	+ 925.0	—0.748	— 13.49
82	Eminent's Raleigh	69011	2	+1325.0	—1.165	— 37.30
	Mabel's Raleigh	P.S. 3722 H. C.	3	+1078.0	+0.133	+ 70.51
	Raleigh's Fairy Boy	83767	10	+ 453.8	—0.714	— 53.67
	The Imported Jap	75265	11	—1533.4	+0.269	— 61.91
	Mean			— 0.5	—0.104	— 15.02
83	Fontaine's Chieftain	97158	--	--	--	--
	Imp. Noble Fontaine Raleigh	91142	5	+ 450.0	—0.492	— 15.04

Sires in Order of Sons' Change in Net Butter-Fat—Continued.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
84	Hood Farm Pogis 9th	55552	39	+ 448.9	+0.242	+ 47.49
	Hood Farm Figgis Torono	90517	3	+2706.3	—0.216	+132.50
	Pogis 99th of Hood Farm	94502	14	+ 995.2	+0.230	+ 82.34
	Pogis 66th of Hood Farm	85015	3	+ 514.7	+0.385	+ 66.86
	Pogis 75th of Hood Farm	94501	7	— 630.8	+0.518	+ 21.00
	Lookout Torono	78593	17	+ 324.7	—0.365	— 7.94
	Tonona Pogis	78657	14	— 826.1	+0.329	— 14.00
	Seven Gates	75925	5	— 115.2	—0.260	— 29.25
	Pogis 95th of Hood Farm	92626	5	—1075.2	+0.205	— 39.71
	Pogis 94th of Hood Farm	90492	2	—1038.5	—0.215	— 75.91
	Tormentor's Torono	78184	5	—1245.4	—0.256	— 90.51
	Hood Farm S. Tormentor	76311	3	—3079.0	+0.057	—219.72
	Mean			— 397.2	+0.037	— 15.85
85	Gedney Farm Oxford Lad	71238	2	+ 128.0	—0.071	+ 1.57
	Royal Majesty	79313	5	+2138.6	—0.264	+ 81.34
	Model's Oxford Lad	66518	5	— 417.8	+0.176	— 6.99
	Sultana's Oxford Lad	76506	3	— 292.0	—0.267	— 40.77
	Gedney Farm Girl's Oxford	75998	14	+ 238.1	—0.576	— 53.27
	Gamboge's Oxford Lad	67284	2	—1441.5	+0.143	— 64.25
	Mean			+ 45.1	—0.158	— 16.79
86	Gamboge's Knight	95698	5	— 610.6	+0.148	— 20.07
	Oxford Brigadier	78529	2	— 848.0	+0.230	— 17.48
87	Gamboge's Oxford Lad	67284	2	—1441.5	+0.143	— 64.25
	Cinxia's Gamboge Lad	90848	3	+ 212.0	—0.326	— 17.69
88	Copper Storrs	61378	--	--	--	--
	Copper Baron	64453	2	+1065.5	—0.988	— 21.24
89	Rioter's Jersey Lad	58901	7	+1415.2	+0.019	+ 87.10
	Jersey Lad's Caspar	71077	5	— 767.0	+0.254	— 21.69
90	Gazelle's King Marigold	55201	--	--	--	--
	Marigold's Exile King	53232	8	—1242.3	+0.500	— 22.37
91	Golden Nero	62052	2	+3369.0	—0.543	+149.77
	Nero's Garfield Lad	77949	2	— 82.0	+0.286	— 22.72
92	Alcedro	58507	--	--	--	--
	Alcarano	69653	4	— 443.2	+0.019	— 23.69
93	Merry Maiden's Millionaire	68540	--	--	--	--
	Oonan's Major	91036	2	— 644.0	+0.118	— 25.33
94	Oonan's Count	57470	8	— 72.3	+0.150	+ 7.55
	Oonan's Conqueror	77851	2	— 624.0	+0.155	— 27.48
95	Flying Fox's Oxford Duke	61439	--	--	--	--
	Flying Fox's Oxford Duke 2d	76316	2	+ 372.5	+0.100	+ 29.30
	Fad	85670	2	—1318.5	—0.074	— 85.61
	Mean			— 473.0	+0.013	— 28.15
96	Noble of Arranche	P. S. 4404 H. C.	--	--	--	--
	Noble's Jolly Golden Lad	104562	2	—1769.5	+0.682	— 29.78
97	Carnation's Fern Lad	63542	--	--	--	--
	Naiad's Golden Lad	67475	3	+ 508.0	—0.622	— 31.57
98	St. Helier of Sheomet	61765	3	—1874.0	—0.400	—150.59
	Romeo of Sheomet	62715	4	—1267.2	+0.497	— 31.75
99	Exile of St. Lambert	13657	--	--	--	--
	Willson's Exile	44065	2	+ 447.0	—0.656	M 33.00
100	Oxfordshire	63548	--	--	--	--
	Lad's Oxfordshire	74564	2	+ 339.5	—0.535	— 33.39
101	Caiest	P.S. 2591 H. C.	--	--	--	--
	Mabel's Poet	65780	5	— 161.6	—0.310	— 36.33
102	Marigold's St. Helier	52657	4	— 152.0	+0.136	+ 4.42
	Merry Miss's Son	76629	5	— 95.6	—0.221	— 26.17
	Marigold's Champion	70801	3	+ 67.7	—0.547	— 47.12
	Mean			— 13.9	—0.384	— 36.65
103	Noble of Oaklands	95700	3	— 453.3	+0.386	+ 4.24
	Imp. Rozel's Noble	96627	2	— 32.5	+0.304	+ 22.76
	Karnak's Noble	87952	4	+ 338.8	—0.348	— 21.25
	Rochette's Noble	96422	2	+ 440.0	—0.864	— 49.84
	Noble Peer	90653	4	—1431.3	—0.152	— 98.85
	Mean			— 171.3	—0.265	— 36.79
104	Hood Farm Torono	60326	34	+2620.1	—0.225	+121.51
	St. Oner's Torono	81219	2	— 32.0	+0.226	+ 20.32
	Hood Farm Torono 21st	83413	4	— 800.5	+0.272	— 20.85

Sires in Order of Sons' Change in Net Butter-Fat—Continued.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
	Hood Farm Torono 20th	82854	19	— 682.9	—0.072	— 45.59
	Fort Hill Farm Torono	72940	2	—1079.0	—0.455	—102.25
	Mean			— 648.6	—0.007	— 37.09
105	Channel King	62762	2	+2332.0	+0.148	+150.30
	Reservation Stoke Pogis	76048	5	— 378.0	—0.211	— 37.98
106	The Imported Jap	75265	11	—1533.4	+0.269	— 61.91
	Gertrude's Jap	93947	2	— 542.0	—0.080	— 38.47
107	Pride's Olga 4th's Son	78574	--	--	--	--
	Rosaire's Olga Lad	87498	13	+ 210.7	—0.482	— 38.93
108	Daisy's Prince of St. L.	75437	2	—1959.0	+0.352	— 73.38
	Prince's Ramaposa	87833	2	— 537.0	—0.128	— 39.83
109	Valentine's Donan	58076	10	+ 23.0	+0.048	+ 5.19
	Valentine's Count	69878	6	— 830.1	+0.139	— 40.75
110	St. Lambert's Rioter King	54896	--	--	--	--
	St. Lambert's Ridgewood King	73247	2	+ 670.0	—0.193	+ 16.32
	Gazelle's Fawn Rioter King	71966	3	—1989.4	+0.260	— 98.85
	Mean			— 659.7	+0.033	— 41.27
111	Pedro's Vidi	71235	2	— 90.5	+0.056	— 0.51
	Glory's Pedro	95123	2	—1538.5	+0.540	— 42.85
112	Merimaid's Oxford King	72826	--	--	--	--
	Oxford King of Fernwood	81379	3	+1039.3	—0.0[illegible]	— 44.37
113	St. Lambert Boy 3d	55001	--	--	--	--
	Pogis Alden Boy	96014	2	—1[illegible]	+0.208	— 45.04
114	St. Lambert Boy 4th	57778	--	--	--	--
	King Allie Rioter	62221	2	— 639.5	—0.116	— 45.11
115	Rosaire's Golden Lad	64554	2	—3387.0	+0.293	—149.95
	Rosaire's Lad of Glenwood	76980	2	— 505.0	—0.198	— 48.79
116	Tornella's Tormentor	56234	--	--	--	--
	Biltmore's Torment	60761	4	— 165.5	—0.492	— 50.61
117	Mabel's Raleigh	P.S. 3722 H. C.	3	+1078.0	+0.133	+ 70.51
	Mabel's Raleigh	77913	3	— 86.7	+0.027	— 1.46
	Fairy Glen's Raleigh	79438	5	— 191.8	—0.291	— 38.32
	Financial Raleigh	86298	4	—1092.0	—0.554	—115.05
	Mean			— 456.8	—0.273	— 51.61
118	Gertie's Stoke Pogis	56492	3	+1688.3	—0.196	+ 70.59
	Mistletoe Pogis	75371	2	— 826.5	—0.044	— 53.30
119	Springhill Pogis	68518	--	--	--	--
	Altama's Pogis	77089	3	— 615.7	—0.217	— 53.31
120	Estelene's Prince	63345	--	--	--	--
	Quintin Owl	77041	3	—1124.4	+0.152	— 56.07
121	Golden Grand	53658	--	--	--	--
	Golden Lad of Gleenwood Farm	62057	3	+1328.4	—0.399	+ 35.08
	Rosaire's Golden Lad	64554	2	—3387.0	+0.293	—149.95
	Mean			—1029.3	—0.053	— 57.43
122	Rebekah's June Boy	67041	--	--	--	--
	Nova Boy of Turner	72135	2	— 248.0	+0.893	— 58.82
123	Golden Interest	66705	--	--	--	--
	Altama Interest	98466	4	—1526.2	+0.315	— 59.39
124	H. F. Golden Fern's Lad	80437	7	—1048.7	—0.361	— 90.49
	Golden Luey's Eminent Lad	85639	7	—1458.1	+0.202	— 60.09
125	Gipsy's King	P.S. 3270 H. C.	--	--	--	--
	Roving Gipsy	67588	2	— 599.5	—0.355	— 64.75
126	Golden Laddie	57431	--	--	--	--
	Golden Laddie of O.	67925	3	— 889.7	—0.170	— 65.75
127	Lord Forfarshire	64890	--	--	--	--
	Lord North	75342	2	— 830.5	—0.249	— 65.98
128	Tivoli St. Lambert Pogis	37466	--	--	--	--
	Inez's Stoke Pogis	51942	4	— 539.5	—0.339	— 66.65
129	Rosebay's Golden of Biltmore	64233	--	--	--	--
	Golden Paul	68919	3	— 457.0	—0.450	— 68.05
130	Golden King of St. Sav.	57499	--	--	--	--
	Oxford John D.	90048	3	+ 377.7	—0.856	— 68.26
131	Eurotas Hugo Pogis	28476	--	--	--	--
	Ben Hur Pogis	38370	2	—1264.5	+0.017	— 68.79
132	Warder	P.S. 3227 H. C.	--	--	--	--

Sires in Order of Sons' Change in Net Butter-Fat—Concluded.

No.	Names of Sire and Sons	Registry No.	No. of Pairs	Net Change in Milk	Net Change in %	Net Change in Fat
	Island Lodestar	67638	6	— 350.4	—0.563	— 70.89
133	Lady Letty's King	69956	--	--	--	--
	Daisy's Prince of St. L.	75437	2	—1959.0	+0.352	— 73.38
134	Olga's Chief	61458	--	--	--	--
	Amy's Chief	74154	4	—1504.3	+0.124	— 76.37
135	Guenon's Lad	54422	--	--	--	--
	Guenon's Lad 2d	62304	2	— 425.0	+0.118	— 15.80
	Combination Golden Lad	50292	3	—2032.3	—0.299	—138.06
	Mean			—1228.7	—0.091	— 76.93
136	Melia Ann's Golden Wolseley	62598	--	--	--	--
	St. Mawes	72053	2	—1196.5	—0.064	— 78.44
137	Volco of Cummington	69725	--	--	--	--
	Pedro of Brick House Farm	88867	3	— 883.7	—0.295	— 82.31
138	Cowslip's Artus	P.S. 3899 H. C.	--	--	--	--
	Cowslip's Ashley	83633	3	—1846.7	+0.165	— 87.42
139	Witch's King	77648	--	--	--	--
	Benedictine King	86100	2	—2617.5	+0.330	— 88.14
140	Oakland Count	77311	--	--	--	--
	Fontaine's Count	84083	2	—1872.0	+0.335	— 80.51
	Violet's Oakland Count	80974	2	—3494.5	+1.100	— 99.71
	Mean			—2683.3	+0.717	— 90.11
141	Zeyer's Champion Pogis	71405	--	--	--	--
	Girldine's Champion Pogis	94004	3	—2380.0	+0.453	— 90.60
142	King's Rioter King	58112	--	--	--	--
	King's Rioter Lawrence	65453	2	—2760.5	+0.540	— 94.96
143	Emanon	52299	--	--	--	--
	Jacoba's Emanon	84177	9	—2190.9	+0.512	— 84.27
	Jacoba's Premier	89296	3	—2363.3	+0.236	—115.10
	Mean			—2277.1	+0.374	— 99.69
144	Alphea's Clotaire	47368	--	--	--	--
	Minaret Exile	56933	9	— 851.0	—0.574	—100.59
145	Brown Lassie's Son	68873	--	--	--	--
	Brown Lassie's Compass	71626	5	— 869.6	—0.604	—100.61
146	Golden Jolly	P.S. 2921 H. C.	--	--	--	--
	Viola's Golden Jolly	79314	2	—2957.0	+0.888	—102.51
147	Imported Oxford Majesty	134090	--	--	--	--
	Oaklands Sultan King	85602	2	—2052.5	+0.033	—103.95
148	Model's Oxford Lad	66518	5	— 417.8	+0.176	— 6.99
	Owl's Model Fox	76617	2	+ 258.5	—0.717	— 49.41
	Mean			—1742.5	—0.227	—107.13
149	Merry Miss' Son	75599	2	—3743.5	+0.262	—164.84
	Adelaide's Merry Pogis	76629	5	— 95.6	—0.221	— 26.17
150	Eminent's Goldmont Lad	91365	3	—2485.7	+0.272	—108.14
	Mona Rose's Glory	70268	--	--	--	--
	Oxford Lad's Owl	92531	5	—1550.4	—0.270	—110.94
151	Sargent Fox	64833	--	--	--	--
	Margery Golden's Fox	72362	4	—2503.7	+0.414	—119.76
152	Golden Fernside	71156	--	--	--	--
	Fern's Air	77589	2	—1945.0	+0.055	—123.55
153	Harry Torment's Signal	39846	--	--	--	--
	Harry B. Gordon	47246	2	—1989.0	—0.138	—124.46
154	Gertie's Son	66463	--	--	--	--
	Gertie's Son's Jamont	73745	2	—1649.5	+0.368	— 45.00
	Gertie's Son's Boy	71825	2	—1328.0	—0.324	—106.18
	Gertie's Son of Washington	83799	3	—2593.4	—0.619	—227.01
	Mean			—1857.0	—0.192	—126.06
155	Melia Ann's Son	22041	--	--	--	--
	Hector Marigold	59121	2	—3507.0	+0.617	—144.12
156	Daisy's Fox	68199	--	--	--	--
	Lady Mary's Fox	82763	2	—2236.5	—0.268	—148.02
157	Tormentor's Signal B.	53643	--	--	--	--
	St. Helier of Sheomet	61765	3	+1874.0	—0.400	—150.59
158	Merry Maiden's Grandson	71003	6	—1062.7	+0.560	— 3.27
	Oonan 23d's Grandson	74887	3	—2031.3	—0.323	—156.92
159	Ethleel 2d's Jubilee	18249	--	--	--	--
	Jubilee of Bois d'Arc	29041	3	—1542.3	—0.810	—162.92

There are in this list 159 bulls which have sons that meet the requirements of this progeny test, and whose transmitting powers are known through it. Of this number, 42 sires have known transmitting qualities since the progeny test was applied on their daughters as well as on their sons. In this list one bull, Hood Farm Stoke Pogis 9th has eleven sons whose transmitting powers for milk production, butter-fat percentage and butter-fat are known.

Certain bulls come out of this critical study of their sons' transmitting power with much to their credit. Among these animals might be mentioned Chief Engineer (2) with two sons which raised the quantity and quality of the milk of their daughters to a marked degree. Hood Farm Pogis is another notable addition to the breed. Among the older bulls Stoke Pogis of Prospect leads in his ability to give his sons the inheritable stuff to cause them to produce quantity and quality in their daughters' milk.

Some disappointments occur. Among these perhaps the greatest are the sons of Hood Farm Torono. These bulls without exception lowered the milk production of their daughters. The net decrease in the butter-fat is not large but still it is significant.

Another disappointment is Eminent with six sons. These sons raised the average milk production of their daughters somewhat but lowered the butter-fat percentage of their milk to such an extent as to result in a net decrease in the butter-fat.

The use of this table may be further exemplified by examining the lists of leading sires for their ability to transmit to their sons the ability to raise the quantity and quality of the milk of their daughters.

The leading native bulls, together with their son's progeny records, are:

Hood Farm Pogis 9th	(84)	— 397.2	+0.037	—15.85
Hood Farm Torono	(104)	— 648.6	—0.007	—37.09
Spermfield Owl	(36)	+ 659.6	—0.030	+35.52
Loretta's King				
Sayda's Heir 3d				
Hector Marigold				
Irene's King Pogis				
Lady Letty's Victor	(133)	—1959.0	+0.352	—73.38

The leading imported bulls, together with their son's progeny records, are:

Interested Prince	(28)	+1671.0	—0.442	+ 52.13
Raleigh's Fairy Boy	(20)	+1772.0	—0.249	+ 77.14
Gamboge's Knight	(86)	— 848.0	+0.230	— 17.48
Royal Majesty	(5)	+2163.3	+0.123	+143.97
Noble of Oaklands	(103)	— 171.3	—0.265	— 36.79
Eminent's Raleigh	(82)	— 0.5	—0.104	— 15.02
The Imported Jap	(106)	— 542.0	—0.080	— 38.47
Gedney Farm Oxford Lad	(85)	+ 45.1	—0.158	— 16.79

Surprising as it seems three of the native sires have no sons that had tested daughters from tested dams. Perhaps still more surprising, in view of the fact that the native bulls' daughters were superior to the imported bulls' daughters when compared with their dams, is the general inferiority of the native bulls' sons to the imported bulls' sons. The best showing made by the sons of one of these native bulls was that made by those of Spermfield Owl. The best showing of an imported bulls' sons was made by those of Royal Majesty. The facts in regard to the merit of these groups of sires need to be tested further. It is one of the purposes of the subsequent section to examine all the bulls' pedigrees for their island and American ancestry and not such a selected sample as the one chosen by Mr. Sibley.

JERSEY SIRES WHICH MATERIALLY ADVANCED THE JERSEY BREED.

The dairyman today looks at a cow from two points of view, how much milk will this cow produce and what is the butter-fat percentage in this milk. It appears beyond question that the cow of superior merit is the animal which produces a large amount of milk and whose milk has a high butter-fat test. If this is so, it appears equally without question that the sire of superior merit is the animal which raises the milk production and butter-fat percentage of his daughters over that of their dams. Table 4 gives the bulls which raised the milk production of their daughters over that of their dams. Table 5 gives the similar data for the butter-fat percentage. By com-

bining the information in these tables it is possible to obtain a table showing the sires which increased the milk production and butter-fat percentage of their daughters over that of their dams. This has been done. The results are shown in table 8.

TABLE 8.

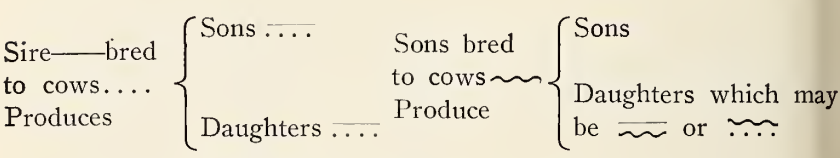
Bulls Which Increased Both Milk and Butter-Fat Per Cent of their Daughters.

No.	Name of Bull	Registry No.	No. of Pairs	Net Increase		
				In Milk	In Fat %	In Net Fat
1	Signal's Successor	72758	3	2899.3	0.202	177.72
2	Golden Glow's Chief	61460	4	2172.4	0.453	161.93
3	Hood Farm Pogis 34th	63300	2	2528.0	0.044	159.24
4	Tormentor's Landseer Signal	69291	4	2326.7	0.292	153.55
5	Clear Brook Chief	74685	2	278.0	1.338	153.31
6	Channel King	62762	2	2332.0	0.148	150.30
7	Majestic Fern	84428	3	2163.3	0.123	143.97
8	Golden Fern's Son	78687	9	1156.5	0.458	109.32
9	Spermfield Owl	57088	26	1695.7	0.027	97.71
10	Sultan of Oaklands	P. S. 3746	3	1104.7	0.385	95.06
11	Chenille's Golden Prince	91769	2	1242.0	0.264	93.06
12	Eurybia's Blue Boy	90591	3	1170.3	0.253	90.17
13	Rioter's Jersey Lad	58001	7	1415.2	0.019	87.10
14	Pogis 99th of Hood Farm	94502	14	995.2	0.230	82.34
15	Jenny's Redfern	70388	2	1582.0	0.030	79.56
16	Mabel's Raleigh	P. S. 3722	3	1078.0	0.133	70.51
17	Pogis 66th of Hood Farm	85015	3	514.7	0.385	66.86
18	Nebraska Lad	71828	2	296.5	0.439	57.14
19	Hood Farm Pogis 9th	55552	39	448.9	0.243	47.49
20	Blue Belle's Gold Fern	79043	3	429.4	0.139	37.08
21	Keepsake's Golden Lad	71325	5	165.2	0.244	32.18
22	Nutley Tones Owl	67837	3	259.0	0.174	30.55
23	Flying Fox's Oxford Duke 2d	76316	2	372.5	0.100	29.30
24	The Owl of Meridale	85853	5	66.2	0.218	24.17
25	Eminent 4th	76078	5	237.8	0.084	21.54
26	Sayda's Heir 3d	74817	15	106.5	0.166	20.87
27	Storr's Golden Lad	68189	2	33.0	0.078	9.80
28	Valentine's Oonan	58075	10	23.0	0.048	5.19

Twenty-eight Jersey sires qualify as bulls which have materially advanced the Jersey breed. These bulls are arranged in order of the net change of the butter-fat between the bull's daughter and the dam to which the bull is bred. The leader of the sires is Signal's Successor who increased the milk production of his daughters 2899.5 pounds, their butter-fat percentage 0.202 per cent and made a net change in the butter-fat of 177.72 pounds. Considering the number of daughter-dam pairs which each bull has, the other bulls of outstanding worth are Golden Glow's Chief, Tormentor's Landseer Signal, Golden Ferris Son, Spermfield Owl, Rioter's Jersey Lad, Pogis

99th of Hood Farm, and Hood Farm Pogis 9th, the order in which the bulls are named representing in some degree at least the relative worth of the bulls.

Examination of the sires in table 8 in connection with the list of the worth of these same sires' sons as given in table 7 is of especial interest as showing a bull's transmitting powers to both his male and female offspring. The test of these sons is of course one generation removed from the test of a bull himself and consequently is not a test of more than half of the inheritable factors which he may transmit to these sons since the mother transmits the other half. A diagram, purposely made simple, will make this clear.



The sire's sons when tested for their merit as shown in the diagram above are also tested for the merit of their dams since the dam of the sons contribute equally with the sire of the sons to the son's daughters. The test of the sire through his sons, consequently, does not have the same value in determining the sire's merit as does the test on his daughters. Taking cognizance of this fact we may now proceed to examine these Jersey sires for their merits in transmitting milk production to both their sons and daughters.

A number of these will not have tested sons. Of those that do have tested sons Spermfield Owl stands first in raising the milk transmitting qualities of his sons. His sons' raised the milk production of their daughters, lowered the butter-fat percentage and raised the butter-fat. A fairly close second to Spermfield Owl was Golden Glow's Chief. This bull's sons also raised the milk production, lowered the butter-fat percentage and raised the butter-fat of the daughters over that of their dams.

Among the bulls which lowered the butter-fat production of their sons' daughters Channel King, Mabel's Raleigh, Hood Farm Pogis 9th and Valentine's Oonan may be mentioned. Of the bulls mentioned Hood Farm Pogis 9th lowered the trans-

mitting qualities of his sons for milk production but raised their butter-fat percentage. The net loss in butter-fat was 15.85 pounds for each daughter sired by a son of Hood Farm Pogis 9th. The poorest bull in the list was Mabel's Raleigh whose sons caused a net loss in their daughter in milk production, butter-fat percentage and butter-fat. Channel King's and Valentine's Oonan's sons cause a loss of butter-fat of 37.98 and 40.75 pounds respectively in their daughters as compared with their dams.

Jersey Sires which Decreased the Milk Production, Butter-Fat Percentage and Butter-Fat of Their Daughters.

If the same reasoning is followed as that in the previous section of the paper, the inferior bull is the bull which lowers the milk production, butter-fat percentage and butter-fat of his daughters as compared with their dams. Tables 4, 5 and 6 allow the determination of bulls which were inferior according to these standards. These bulls are shown in table 9.

There are 47 of these inferior sires as measured by the standard of what their progeny did. There are consequently in the Jersey breed nearly twice as many bulls who lowered the production of their daughters as there are bulls who raised the milk production and butter-fat percentage of their daughters. This fact can well be viewed with alarm. It brings home more forcefully than has yet been done the need for exact knowledge of the mode of inheritance of milk and butter-fat production. The Maine Agricultural Experiment Station recognizes the need for this information and has a project under way to attempt to obtain the facts (1).

This list of sires, inferior in their transmitting qualities, is arranged according to the number of pounds of net butter-fat that their daughters' butter-fat production was less than their dams' butter-fat production. The sire which caused his daughters to drop farthest below their dams was the first bull in the list, Gertie's Son of Washington. The sire which caused his daughters to drop least was Prince Noel. Considering the number of daughter-dam pairs the sires, Hood Farm Torono

20th, Minaret Exile, Eminent 10th and H. F. Golden Fern's Lad were those which were most disappointing.

TABLE 9.

Bulls Which Decreased Both Milk and Fat Per Cent.

No.	Name of Bull	Registry No.	No. of Pairs	Net Decrease		
				In Milk Lbs.	In Fat %	In Net Fat Lbs.
1	Gertie's Son of Washington	83799	3	2593.4	0.619	227.01
2	Jubilee of Bois d'Arc	29041	3	1542.3	0.810	162.92
3	Oonan 23d's Grandson	74887	3	2031.3	0.323	156.92
4	St. Helier of Sheomet	61765	3	1874.0	0.400	150.59
5	Lady Mary's Fox	82763	2	2236.5	0.268	148.02
6	Combination Golden Lad	59292	3	2032.3	0.299	138.06
7	Harry B. Gordon	47246	2	1989.0	0.138	124.46
8	Financial Raleigh	86298	4	1092.0	0.554	115.05
9	Mona Rose's Glory	92531	5	1550.4	0.270	110.94
10	Gertie's Son's Boy	71825	2	1328.0	0.324	106.18
11	Fort Hill Farm Torono	72940	2	1079.0	0.455	102.25
12	Brown Lassie's Compass	71626	5	869.6	0.604	100.61
13	Minaret Exile	56933	9	851.0	0.574	100.59
14	Noble Peer	90653	4	1431.3	0.152	98.85
15	Tormentor's Torono	78184	5	1245.4	0.256	90.51
16	H. F. Golden Fern's Lad	80437	7	1048.7	0.361	90.49
17	Fad	85670	2	1318.5	0.074	85.61
18	Pedro of Brick House Farm	88867	3	883.7	0.295	82.31
19	St. Mawes	72053	2	1196.5	0.064	78.44
20	Fontaine's Duke	61709	6	861.7	0.275	76.54
21	Pogis 94th of Hood Farm	90492	2	1038.5	0.215	75.91
22	Island Lodestar	67638	6	350.4	0.563	70.89
23	Golden Paul	68919	3	457.0	0.450	68.05
24	Inez's Stoke Pogis	51942	4	539.5	0.339	66.65
25	Lord North	75342	2	830.5	0.249	65.98
26	Golden Laddie of O.	67925	3	889.7	0.170	65.75
27	Roving Gipsy	67588	2	599.5	0.355	64.75
28	Eminent 10th	75753	9	599.0	0.346	60.15
29	Altama's Pogis	77089	3	615.7	0.217	53.31
30	Mistletoe Pogis	75371	2	826.5	0.044	53.30
31	Biltmore's Torment	60761	4	165.5	0.492	50.61
32	Rosaire's Lad of Glenwood	76580	2	505.0	0.198	48.79
33	Imp. King of Hambie	65298	2	43.5	0.599	48.02
34	Olga Hazel Pogis	95042	2	698.5	0.094	46.97
35	Hood Farm Torono 20th	82854	19	682.9	0.072	45.59
36	King Allie Rioter	62221	2	639.5	0.115	45.11
37	Sultana's Oxford Lad	76506	3	292.0	0.267	40.77
38	Prince Ramaposa	87833	2	537.0	0.128	39.83
39	Gertrude's Jap	93947	2	542.0	0.080	38.47
40	Fairy Glen's Raleigh	79438	5	191.8	0.291	38.32
41	Reservation Stoke Pogis	76048	5	378.0	0.211	37.98
42	Mabel's Poet	65780	5	161.6	0.310	36.33
43	Seven Gates	75925	5	115.2	0.260	29.25
44	Meridale Interested Prince	86473	6	438.4	0.014	26.55
45	Merry Miss' Son	76629	5	95.6	0.221	26.17
46	Fontaine's Caiest	81118	5	142.8	0.077	15.01
47	Prince Noel	74140	4	8.8	0.148	13.04

It is of interest to examine what the sons of these inferior bulls did to their daughters' production. The information for this is given in table 7. Of the sires in this list which lowered the daughters' production Fairy Glen's Raleigh raised the

transmitting qualities of his son's (Queen's Raleigh) daughters in their milk production, lowered their butter-fat percentage and made a net gain in their butter-fat of 38.32 pounds on the average for each daughter. Among the other bulls of table 9 whose sons raised their daughters is Fontaine's Duke.

Of those which lowered the transmitting qualities of their sons for butter-fat Mabel's Poet, Island Lodestar and Hood Farm Golden Fern's Lad stand in about the order named as to their worth in transmitting high milk and butter-fat production to their sons.

Ancestral Analysis of Sires with Superior and Inferior Transmitting Powers for Milk Production, Butter-Fat Percentage and Butter-Fat.

On page 102 the authors defined their conception of what constitutes a superior bull. Table 8 contains the list of such superior sires arranged according to their merit. Following this discussion is given a list of the inferior sires as judged by what their progeny did. These two lists contain the sires at the two extremes of the Jersey breed. It is proposed to subject the pedigrees of these bulls in each of these lists to a careful analysis of their inbreeding and relationship. The formulae and methods of calculation of these variables have been discussed on page 102 of this paper. The Z_1, Z_2 and Z_3 of tables 10 and 11 stand respectively for the second, third, and fourth generations inbreeding coefficients. The Z_{T_3} stands for the amount of inbreeding which has taken place as compared with the total possible amount. The K_2, K_3 and K_4 stand for the degree of relationship which exists in the pedigree of the second, third and fourth generation respectively. The figures given for the sires Golden Glow's Chief, Channel King, Spermfield Owl, Sultan of Oaklands, Mabel's Raleigh, Blue Belle's Golden Fern, and Eminent 4th are not entirely correct as the pedigrees of these bulls are not complete since they run into foundation stock.

Besides this analysis, the pedigrees were studied to determine the amount of Island bred Jersey ancestry which each of these sires had. This was classified in two ways; as the number of island bred males occurring in the sire's side of the pedigree

TABLE 10.

Ancestral Analysis of Bulls Which Increased Both Milk and Fat Per Cent.

No.	Name of Bull	Registry No.	Z_1	Z_2	Z_3	ZT_3	K_2	K_3	K_4	Island Bred Ancestry								Per cent Island Blood			
										Absolute Nos.					Percentages								
										♂ ♂	♀ ♀	Sire's side	Dam's side		♂ ♂	♀ ♀	Sire's side	Dam's side		♂ ♂	♀ ♀	Sire's side	Dam's side
1	Signal's Successor	72758	0	0	12.5	5.9	0	0	12.5	0	1	0	1		0	6.7	0	6.7		0	12.5	0	12.5
2	Golden Glow's Chief	61460	0	0	6.3	3.0	0	0	0	7	8	0	15		46.7	53.3	0	100.0		50.0	50.0	0	100.0
3	Hood Farm Pogis 34th	63300	0	0	6.3	3.0	0	0	0	4	4	2	6		26.7	26.7	13.3	40.0		37.5	37.5	25.0	50.0
4	Tormentor's Landseer Signal	69291	0	12.5	25.0	17.7	0	0	12.5	5	2	7	0		33.3	13.3	46.7	0		37.5	25.0	62.5	0
5	Clear Brook Chief	74685	0	12.5	12.5	10.0	0	0	0	3	2	0	5		20.0	13.3	0	33.3		37.5	25.0	0	62.5
6	Channel King	62762	0	0	6.3	3.0	0	0	0	10	11	6	15		66.7	73.3	40.0	100.0		75.0	75.0	50.0	100.0
7	Majestic Fern	84428	0	0	18.7	8.8	0	0	12.5	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
8	Golden Fern's Son	78687	0	12.5	18.7	14.7	0	0	0	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
9	Spermfield Owl	57088	0	0	6.3	3.0	0	0	0	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
10	Sultan of Oaklands	P. S. 3746	0	12.5	18.7	14.7	0	25.0	25.0	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
11	Chenille's Golden Prince	91769	0	0	6.3	3.0	0	0	0	8	7	15	0		53.3	46.7	100.0	0		50.0	50.0	100.0	0
12	Eurybia's Blue Boy	90591	0	0	0	0.0	0	0	0	1	0	0	1		6.7	0	0	6.7		12.5	0	0	12.5
13	Rioter's Jersey Lad	58001	0	12.5	31.3	20.6	0	0	25.0	1	1	0	2		6.7	6.7	0	13.3		12.5	12.5	0	25.0
14	Pogis 99th of Hood Farm	94502	0	0	6.3	3.0	0	0	12.5	1	1	2	0		6.7	6.7	13.3	0		12.5	12.5	25.0	0
15	Jenny's Redfern	70388	0	12.5	18.7	14.7	0	0	0	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
16	Mabel's Raleigh	P. S. 3722	0	0	25.0	11.8	0	0	12.5	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
17	Pogis 66th of Hood Farm	85015	0	0	6.3	3.0	0	0	0	8	9	2	15		53.3	60.0	13.3	100.0		62.5	62.5	25.0	100.0
18	Nebraska Lad	71828	0	0	6.3	3.0	0	0	0	9	7	15	1		60.0	46.7	100.0	6.7		62.5	50.0	100.0	12.5
19	Hood Farm Pogis 9th	55552	0	0	6.3	3.0	0	0	0	5	4	2	7		33.3	26.7	13.3	46.7		50.0	37.5	25.0	62.5
20	Blue Belle's Gold Fern	79043	0	12.5	18.7	14.7	0	25.0	25.0	14	15	14	15		93.3	100.0	93.3	100.0		100.0	100.0	100.0	100.0
21	Keepsake's Golden Lad	71325	0	0	6.3	3.0	0	0	0	7	7	14	0		46.7	46.7	93.3	0		50.0	50.0	100.0	0
22	Nutley Tones Owl	67837	0	0	0	0.0	0	0	0	8	7	14	1		53.3	46.7	93.3	6.7		62.5	50.0	100.0	12.5
23	Flying Fox's Oxford Duke 2d	76316	0	0	6.3	3.0	0	0	0	8	7	15	0		53.3	46.7	100.0	0		50.0	50.0	100.0	0
24	The Owl of Meridale	85853	0	0	0	0.0	0	0	0	11	10	14	7		73.3	66.7	93.3	46.7		75.0	75.0	100.0	50.0
25	Eminent 4th	76078	0	12.5	18.7	14.7	0	25.0	25.0	15	15	15	15		100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
26	Sayda's Heir 3d	74817	0	0	0	0.0	0	0	0	1	1	2	0		6.7	6.7	13.3	0		12.5	12.5	25.0	0
27	Storr's Golden Lad	68189	0	0	0	0.0	0	0	0	7	7	14	0		46.7	46.7	93.3	0		50.0	50.0	100.0	0
28	Valentine's Oonan	58076	0	12.5	25.0	17.7	0	25.0	37.5	3	2	4	1		20.0	13.3	26.7	6.7		37.5	25.0	50.0	12.5
	Means:									8.07	7.79	8.82	7.04		53.8	51.9	58.8	46.9		58.5	55.8	63.8	50.4

or as occurring on the dam's side of the pedigree. By a comparison of this information for the superior sires with the corresponding information on the inferior sires some insight may be gained as to the effect of inbreeding and relationship in making a superior or inferior sire and as to the relative values of American and Island breeding. Table 10 gives this information for the sires of table 8 classified according to their merits as was done in that table.

In the first three columns of table 10 are given the number, name and registry number of the sire. The four following columns contain the inbreeding for each generation and the constant expressing the amount of inbreeding in relation to the maximum possible amount of a continued brother and sister mating. These figures show that no inbreeding has taken place in second generation in the pedigree of these twenty-eight superior sires. In the third generation nine bulls had a repeated ancestor in their pedigree. Out of the twenty-eight sires all but five had some inbreeding before the fifth generation. The total ranges from 0 to 20.6 per cent of what could occur for a brother and sister mating. The bull exhibiting the greatest amount of inbreeding was Rioter's Jersey Lad. The pedigree of this bull is given on page 146.

The animals marked with the solid circles are repeated previously in the pedigree. These marked with an open circle containing a cross are ancestors of repeated animals. In this pedigree the repeated animals are Ida's Riotor of St. Lambert, Bachelor of St. Lambert, Ida of St. Lambert and Ida's Stoke Pogis. The inbreeding which occurs in the pedigree of this bull is 20.6. The average coefficient of total inbreeding for this group of bulls is 7.08 per cent of that which would have occurred in continued brother and sister matings.

The next three columns are taken up with the coefficients showing the degree of relationship within the pedigrees. No bull in the pedigree had ancestors which were related in the second generation. In the third ancestral generation there were only four sires out of the twenty-eight which had related ancestors. In the fourth generation ten sires had ancestors known to be related. The pedigree of Rioter's Jersey Lad 58001 shows such related ancestors in Bachelor of St. Lambert and Ida of St. Lambert.

PEDIGREE OF RIOTER'S JERSEY LAD 58001.

Maine Agr. Exp. Sta.—Standard Pedigree Blank

Sheet No.

Sex ♂

No. 58001 Rioter's Jersey Lad

♂ No. 41012 Ida's Rioter of St. L. 11th

♀ No. 99422 Lad's Lily

No. 13656 ♂ Ida's Rioter of St. L.	No. 4558 ♂ Bachelor of St. L.	No. 3143 ♂ Orloff
		No. 6638 ♀ Charity of St. L.
	No. 24990 ♀ Ida of St. L.	No. 2238 ♂ Stoke Pogis 3d
		No. 5122 ♀ Kathleen of St. L.
No. 62474 ♀ Dew	No. 13656 ♂ ● Ida's Rioter of St. L.	No. 4558 ♂ ⊕ Bachelor of St. L.
		No. 24990 ♀ ⊕ Ida of St. L.
	No. 8612 ♀ Lady Appel	No. 2219 ♂ Young St. Martin
		No. 5900 ♀ Isolda
No. 19289 ♂ Pogis Lad	No. 13658 ♂ Ida's Stoke Pogis	No. 4558 ♂ ● Bachelor of St. L.
		No. 24990 ♀ ● Ida of St. L.
	No. 12213 ♀ Daisy Brown	No. F. S. 259 ♂ Tormentor
		No. 9522 ♀ Heedless
No. 59836 ♀ Lily Adonis	No. 20881 ♂ Wrangler	No. 17236 ♂ Roonan's Signal
		No. 17615 ♀ Baron's Sophie
	No. 49954 ♀ Lily Martin	No. 13658 ♂ ● Ida's Stoke Pogis
		No. 32915 ♀ Sigletta

The ancestry of these sires is classified first as the number of males and number of females in the pedigree of each of the twenty-eight sires which were of island breeding. One bull, Signal's Successor, had no male ancestry up to the fifth generation which was island bred. Eurybia's Blue Boy had no female ancestry up to the fifth generation which were of island breeding. Outside of these two bulls all the other sires had island bred ancestry on both sides of the pedigree. Seven of the sires listed had all island ancestry. Out of a possible 15 male ancestors and 15 female ancestors the average for this group of twenty-eight sires was 8.07 male and 7.79 female ancestors which were island bred. The leading sires of the Jersey breed were consequently more than half island breeding. The percentages, shown under percentages, were 53.8 and 51.9.

These island ancestors are also classified as to whether they occur on the sire's side or on the dam's side of the pedigree. When so classified nine of these superior sires are by sires of full island breeding. Five lack only one ancestor (the sire)

to make them entirely island bred. On the dam's side of the pedigree eleven are of strict island breeding. The average number of ancestors on the sire's side of the pedigree is 8.82 and on the dam's side of the pedigree 7.04. The percentages of the total number of possible island bred ancestors on the sire's side of the pedigree are 58.8 and on the dam's side 46.9.

These figures show that the pedigrees of these twenty-eight superior bulls have slightly over one-half island ancestry. The two methods of classification show that there are more bulls of island pedigree than cows in the breeding of these sires and that more island bred animals of either sex are found on the sire's side of the pedigree than on the dam's side of the pedigree.

The last four columns of table 10 deal with the percentages which these island-bred great-great-grand parents form of the total great-great-grand parents of their class. This information is classified into the same groups that the previous information for the whole pedigree was classified. These figures show that of the possible male great-great-grand parents 58.5 per cent were island bred. Of the female great-great-grand parents there were 55.8 per cent island bred. The males and females of the fourth generation were more than half island bred, the males having more of island breeding than the females.

The information was also classified into percentage of island breeding on sire's side and on the dam's side of the fourth generation of the pedigree. The number of island bred great-great-grandparents on the sire's side constitute 63.8 per cent of the total number. On the dam's side 50.4 per cent of the total number were island bred. The great-great-grandparents on the sire's side of the pedigree have consequently more island bred individuals than do the great-great grandparents on the dam's side of the pedigree.

Entirely similar information for the inferior sires may now be considered. This information is collected in table 11. The arrangement of this table is entirely similar to that of the preceding table, No. 10. The methods of deriving the figures are discussed in connection with that table.

The figures given for the sires St. Helier of Sheomet, Financial Raleigh, Mona Rose's Glory, Noble Peer, Pogis 94th of Hood Farm, Island Lodestar, Eminent 10th, Imp. King of

TABLE 11.

Ancestral Analysis of Bulls which Decreased both Milk and Fat Per Cent.

No.	Name of Bull	Registry No.	Z_1	Z_2	Z_3	ZT_3	K_2	K_3	K_4	Island Bred Ancestry										Per cent Island Blood					
										Absolute Nos.						Percentages									
										♂	♂	♀	♀	Sire's side	Dam's side	♂	♂	♀	♀	Sire's side	Dam's side	♂	♂	♀	♀	Sire's side	Dam's side
1	Gertie's Son of Washington	83799	0	12.5	12.5	10.0	0	25.0	25.0	1	1	2	0	6.7	6.7	13.3	0	12.5	12.5	25.0	0						
2	Jubilee of Bois d'Arc	29041	0	0	0	0.0	0	0	0	6	5	7	4	40.0	33.3	46.7	26.7	62.5	50.0	62.5	50.0						
3	Oonan 23d's Grandson	74887	0	0	12.5	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4	St. Helier of Sheomet	61765	0	12.5	18.7	14.7	0	0	0	4	2	3	3	26.7	13.3	20.0	20.0	25.0	25.0	25.0	25.0						
5	Lady Mary's Fox	82763	0	0	6.3	3.0	0	0	0	7	6	13	0	46.7	40.0	86.7	0	50.0	50.0	100.0	0						
6	Combination Golden Lad	59292	0	0	12.5	5.9	0	0	0	9	7	15	1	60.0	46.7	100.0	6.7	62.5	50.0	100.0	12.5						
7	Harry B. Gordon	47246	0	12.5	12.5	10.0	0	25.0	25.0	4	3	5	2	26.7	20.0	33.3	13.3	37.5	37.5	50.0	25.0						
8	Financial Raleigh	P. S. 4228	0	0	6.3	3.0	0	0	0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
9	Mona Rose's Glory	92531	0	0	18.7	8.8	0	0	12.5	9	8	14	3	60.0	53.3	93.3	20.0	62.5	62.5	100.0	25.0						
10	Gertie's Son's Boy	71825	0	0	12.5	5.9	0	0	12.5	1	1	2	0	6.7	6.7	13.3	0	12.5	12.5	25.0	0						
11	Fort Hill Farm Torono	72940	0	0	6.3	3.0	0	0	0	4	2	6	0	26.7	13.3	40.0	0	37.5	25.0	62.5	0						
12	Brown Lassie's Compass	71626	0	37.5	37.5	30.0	0	25.0	25.0	0	0	0	0	0	0	0	0	0	0	0	0						
13	Minaret Exile	56933	0	12.5	37.5	23.5	0	0	12.5	2	0	2	0	13.3	0	13.3	0	25.0	0	25.0	0						
14	Noble Peer	P. S. 4458	0	0	0	0.0	0	0	0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
15	Tormentor's Torono	78184	0	12.5	12.5	10.0	0	25.0	25.0	3	2	2	3	20.0	13.3	13.3	20.0	37.5	25.0	25.0	37.5						
16	H. F. Golden Fern's Lad	80437	0	25.0	25.0	20.0	0	25.0	25.0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
17	Fad	85670	0	0	0	0.0	0	0	0	9	8	15	2	60.0	53.3	100.0	13.3	62.5	62.5	100.0	25.0						
18	Pedro of Brick House Farm	88867	0	0	6.3	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19	St. Mawes	72053	0	12.5	12.5	10.0	0	25.0	25.0	6	7	4	9	40.0	46.7	26.7	60.0	50.0	62.5	37.5	75.0						
20	Fontaine's Duke	61709	0	12.5	18.7	14.7	0	25.0	25.0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
21	Pogis 94th of Hood Farm	90492	0	0	0	0.0	0	0	0	8	8	2	14	53.3	53.3	13.3	93.3	62.5	62.5	25.0	100.0						
22	Island Lodestar	67638	0	12.5	12.5	10.0	0	25.0	25.0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
23	Golden Paul	68919	0	12.5	25.0	17.7	0	0	0	8	8	14	2	53.3	53.3	93.3	13.3	62.5	62.5	100.0	25.0						
24	Inez's Stoke Pogis	51942	0	0	6.3	3.0	0	0	0	0	1	1	0	0	6.7	6.7	0	0	12.5	0	12.5						
25	Lord North	75342	0	0	0	0.0	0	0	0	9	10	15	4	60.0	66.7	100.0	26.7	62.5	75.0	100.0	37.5						
26	Golden Laddie of C.	67925	0	0	6.3	7.0	0	0	0	8	7	15	0	53.3	46.7	100.0	0	50.0	50.0	100.0	0						
27	Roving Gipsy	67588	0	0	0	0.0	0	0	0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
28	Eminent 10th	75753	0	12.5	18.7	14.7	0	25.0	25.0	15	14	15	14	100.0	93.3	100.0	93.3	100.0	100.0	100.0	100.0						

Ancestral Analysis of Bulls which Decreased both Milk and Fat Per Cent—Concluded.

No.	Name of Bull	Registry No.	Z_1	Z_2	Z_3	Z_{T3}	K_2	K_3	K_4	Island Bred Ancestry								Per cent Island Blood			
										Absolute Nos.				Percentages							
										♂ ♂	♀ ♀	Sire's side	Dam's side	♂ ♂	♀ ♀	Sire's side	Dam's side	♂ ♂	♀ ♀	Sire's side	Dam's side
29	Altama's Pogis	77089	0	12.5	12.5	10.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	Mistletoe Pogis	75371	0	0	18.7	8.8	0	0	0	1	1	2	0	6.7	6.7	13.3	0	12.5	12.5	25.0	0
31	Biltmore's Torment	60761	0	12.5	18.7	14.7	0	0	0	3	1	3	1	20.0	6.7	20.0	6.7	37.5	12.5	37.5	12.5
32	Rosaire's Lad of Glenwood	76580	0	12.5	12.5	10.0	0	0	0	7	7	14	0	46.7	46.7	93.3	0	50.0	50.0	100.0	0
33	Imp. King of Hambie	P. S. 3300	0	0	12.5	5.9	0	0	0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
34	Olga Hazel Pogis	95042	0	12.5	12.5	10.0	0	0	0	0	1	0	1	0	6.7	0	6.7	0	12.5	0	12.5
35	Hood Farm, Torono 20th	82854	0	12.5	25.0	17.7	0	25.0	37.5	6	4	6	4	40.0	26.7	40.0	26.7	62.5	50.0	62.5	50.0
36	King Allie Rioter	62221	0	25.0	31.3	26.5	0	25.0	37.5	0	1	0	1	0	6.7	0	6.7	0	12.5	0	12.5
37	Sultana's Oxford Lad	76506	0	12.5	25.0	17.7	0	25.0	37.5	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
38	Prince Ramaposa	87833	0	0	6.3	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	Gertrude's Jap	93947	0	0	0	0.0	0	0	0	8	7	15	0	53.3	46.7	100.0	0	50.0	50.0	100.0	0
40	Fairy Glen's Raleigh	P. S. 4003	0	0	0	0.0	0	0	0	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
41	Reservation Stoke Pogis	76048	0	0	6.3	3.0	0	0	0	4	5	9	0	26.7	33.3	60.0	0	37.5	37.5	75.0	0
42	Mabel's Poet	P. S. 2964	0	12.5	25.0	17.7	0	25.0	37.5	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
43	Seven Gates	75925	0	0	0	0.0	0	0	0	8	9	2	15	53.3	60.0	13.3	100.0	62.5	62.5	25.0	100.0
44	Meridale Interested Prince	86473	0	0	0	0.0	0	0	0	8	7	15	0	53.3	46.7	100.0	0	50.0	50.0	100.0	0
45	Merry Miss' Son	76629	0	0	0	0.0	0	0	0	2	0	1	1	13.3	0	6.7	6.7	25.0	0	12.5	12.5
46	Fontaine's Caiest	81118	25.0	25.0	37.5	41.2	50.0	50.0	62.5	15	15	15	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
47	Prince Noel	74140	25.0	25.0	31.3	38.4	50.0	50.0	50.0	1	0	1	0	6.7	0	6.7	0	12.5	0	12.5	0
	Means:									6.94	6.55	8.19	5.30	46.3	43.7	54.6	35.3	50.5	48.7	59.8	39.4

Hambie, Gertrude's Jap, Fairy Glen's Raleigh, and Fontaine's Caiest are not entirely correct as the pedigrees of these bulls are not complete since they run into foundation stock.

The coefficients of inbreeding for the pedigrees of these inferior bulls show that out of the 47 sires only two have repeated ancestors in the second ancestral generation. One of these sires is of island breeding. The other is not. The inbreeding in the two succeeding generations increases markedly. The total inbreeding as measured by Z_{T_3} ranges for the different bulls from nothing to 41.18 per cent of the total possible inbreeding. The average is 9.65 per cent for the forty-seven sires. This average is 2.57 higher than is the total inbreeding for the superior sires. The superior sires are consequently less inbred than the inferior sires.

Of the forty-seven sires eighteen show ancestors in the sire's side of the pedigree which are repeated in the dam's side making the sire and dam related. The pedigrees for the superior sires showed 10 where the sire and dam were related. Considering the difference in the numbers of these two series there is, proportionately, about the same number of related sires and dams bred together to give either set of sires.

The pedigree analysis for island breeding shows that there are five which have no island ancestry either males or females up to the fifth generation. There are six sires which have island ancestry only through one side of the pedigree. As already pointed out the sires of superior merit have only two sires in this class (as few island ancestors). To this extent, at least, the superior sires have more island blood than do the inferior sires. The mean number of males of island breeding occurring in the pedigrees were 6.94 and the mean number of females of island breeding 6.55 for these inferior sires. The figures for the sires which increased the production of their daughters as previously quoted are 8.07 for the males and 7.79 for the females. There are consequently more island bred males and more island bred females in the pedigrees of the best class of sires than in the class of sires which lower the production of their daughters.

This information as to island ancestry is classified also as to whether the island ancestor occurs in the sire's or dam's side of the pedigree. The largest possible number of island ances-

tors up to and including the fourth generation in the sire's or dam's side of the pedigree is fifteen. There are eighteen sires of pure island breeding on their father's side. Four other sires have practically complete island breeding. The sires of superior transmitting qualities have 14 sires practically island bred on their sire's side. This in proportion to the number of each group means that the superior sires have a larger amount of island breeding than do the sires in the inferior group.

On the dam's side of these pedigrees there are twelve with complete island breeding and two lacking only one individual. The pedigrees of the sires which raise the production of their daughters contain eleven sires whose dams are of strict island breeding. The amount of island breeding found in superior sires is consequently greater than is the amount found in the sires which lower the production of their daughters when the relative number of the two classes of individuals is considered.

These facts are borne out by the percentages for the whole pedigree and for the great-great grandparents. The sires which raise the production of their daughters over that of their dams contain up to the fifth ancestral generation more island breeding than do the sires which lower the production of their daughters over that of their dams. In both groups of sires shown in tables 10 and 11 there are more island bred bulls than cows. The sire's sire shows more island bred stock in his pedigree up to the fourth generation than does the sire's dam.

Animals Repeated in the Pedigree of the Sires which Raised the Production of their Daughters.

If we accept provisionally the old saying that, "like begets like" it should follow that the ancestors within the pedigree of superior sires should themselves be worthy animals. If a pedigree study of a group of such superior sires is made, the animals most repeated in a given generation should be the best animals for they have the greatest opportunity to transmit high production to their progeny which is known to carry high production. Some insight should be gained, as to the worth of a given animal by such a study even though the animals may not have any other obtainable record. This is especially true in connection with this study since the pedigrees of the sires which

did not transmit high production to their daughters are also known and a comparison may be made of the individuals repeated in the superior sires pedigree with those repeated in the inferior sires pedigree.

Before beginning this study it was decided that any individual which was not repeated at least once in the pedigrees of a given group of sires could not have contributed any noticeable amount to making the group as a whole worthy or unworthy. Accordingly the study will confine itself to those animals that were repeated at least once.

Table 12 gives the animals repeated in the pedigrees of the sires which increased the milk production and butter-fat percentage of their daughter over that of their dams.

TABLE 12.

Animals Repeated in Pedigrees of Sires which Increased the Milk Production and Butter-Fat Percentage of their Daughters as Compared with that of their Dams.

Sire's Side of Pedigree FIRST GENERATION Name and No.	Number of Appearances	Dam's Side of Pedigree FIRST GENERATION Name and No.	Number of Appearances
Imp. Golden Fern's Lad 2160	2	Figgis 76106	1
Hood Farm Pogis 40684	2	Spermfield Lassie 5099	1
Spermfield Owl 57088	2		
Hood Farm Pogis 9th 55552	2		
Chief Engineer 47148	2		
Eminent 2532	1		
The Owl 2195	1		
Stoke Pogis of Prospect 29121	1		
SECOND GENERATION		SECOND GENERATION	
Oonan's Pogis 17165	3	Sophie's Tormentor 20883	2
Imp. Golden Fern's Lad 2160	2	Imp. Golden Fern's Lad 2160	2
Hood Farm Pogis 40684	2	Eminent 2532	1
The Owl 2195	2	Signalona's Ben Signal 43521	1
Boyle 1559	2	Champion Flying Fox 2729	1
Willoh 2855	2	Spermlight 2d 4157	1
Brown Bessie's Diploma 39344	2	Sir Julius 1547	1
Champion Flying Fox 2729	2	Nutley's Son 31201	1
Golden Fern 4711	2	Birdsey's Surprise 48326	1
Sulphide 88038	2	Sultanne 9th 1145	1
Kathlettas' Fancy 60738	2		
Spermfield Lassie 5099	2		
Figgis 76106	2		
Ida's Rioter of St. L. 13656	1		
Signalona's Ben Signal 143521	1		
Marion 1690	1		
Stoke Pogis 5th 5987	1		
Alicante 3880	1		
Eminent 2532	1		
Ida Marigold 32615	1		
Eminence 7124	1		
Imp. Blue Belle 4307	1		

THIRD GENERATION		THIRD GENERATION	
Golden Lad 1242	8	Boyle	3
Oonan 1485	3	Oonan's Tormentor 22280	2
Imp. Golden Fern's Lad	3	Imp. Golden Fern's Lad 2160	2
Ida's Stoke Pogis	3	Tormentor 259	2
Sultana's Rosette	3	Sophie's Tormentor 20883	2
Tormentor 259	2	Flyaway 4856	2
Ida's Landseer 17745	2	Baron's Sophie 17615	2
Brown Bessie's Son 34550	2	Oxford Lass 3582 P. S.	2
Golden Prince 2502	2	Sultana's Rosette 2881	2
Blanchard 7th 6909	2	Golden Fern 4711	2
Prince of Mahaska 16159	2		
Custa 29637	2		
Oonan's Pogis 17165	2		
Boyle 1559	2		
Ida's Rioter of St. L. 13656	2		
Marion 1690	2		
Alicante 3880	2		
Sophie's Tormentor 20883	2		
Spermlight 2d 4157	2		
Sir Julius 1547	2		
Birdsey's Surprise 48326	2		
Tootsie 3214	2		
Brown Fern 2d 1944	2		
Kathletta 19567	2		
Sombre 80796	2		
Golden Fern 4711	2		
Kathlettas' Fancy 60738	2		

FOURTH GENERATION		FOURTH GENERATION	
Sultanne's Favorite 873	9	Golden Lad	10
Golden Lass 4th 2447	8	Tormentor	7
Golden Lad 1242	7	Boyle 1559	3
Bachelor of St. L. 4558	5	Ida's Stoke Pogis 13658	3
Ida of St. L. 24990	5	Baron's Sophie 17615	3
Boyle 1559	4	Tootsie 3214	3
Tormentor 259	4		
Ida's Stoke Pogis 13658	4		
Oonan 1485	3		
Count Wolseley 928	3		
Rajah 340	3		
Sarabond 797	3		
Onoo 1247	3		
Rosette 4th 2128	3		
Golden Fern 4711	3		
Sultana's Rosette 2881	3		

The outstanding feature of this table is noticeable on inspection. The number of individuals repeated on the dam's side of the pedigree is only a fraction of those repeated on the sire's side of the pedigree. Since the popularity of an animal is based on what is conceived to be his worth, it follows from the above that the animals considered to be worth most are included in the sire's side of the pedigree more often than they are included in the dam's side of the pedigree. Such a selection would seem to mean that the sires are more carefully chosen than the dams to which they are bred. This would probably follow from the obvious difference in the reproductive capacities of a bull and a cow allowing as it does more freedom of choice for the bull than for the cow.

The animals occurring in the first generation of any pedigree do not have the same chance to repeat as do the animals in the second generation, due to the fact that the actual number of animals in the first generation is only half that in the second generation. Likewise the animals in the second generation do not have the same chance to repeat as do the animals in generations further removed. It is consequently more to the credit of any animal to be repeated once in the first generation than to be repeated once in subsequent generations. This point should be kept in mind in viewing the evidence presented in the table.

Some notable names appear repeated in the first generation on the sire's side of the pedigrees, Imp. Golden Fern's Lad P. S. 2160, Hood Farm Pogis 40684, Spermfield Owl 57088, Hood Farm Pogis 9th 55552 and Chief Engineer 47148. Many of these animals are repeated in the succeeding generations. Considering the number of females which appear more than once, it is a good deal to the credit of Figgis 76106 and Spermfield Lassie 5099 to be each the dam of one of the sire's transmitting high milk production and butter-fat percentage to their daughters as well as having other appearances in the pedigrees of these sires in generations further removed.

The total number of times an animal appears in the pedigrees is of most interest. Golden Lad 1242 stands head and shoulders above the other animals in this particular with 25 appearances, 15 on the sire's side of the pedigree and 10 on the dam's side. The other animals come in the order named. The numbers in parenthesis give (1) the number of appearances on the sire's side of the pedigrees and (2) the number on the dam's side of the pedigrees.

Boyle 1559 (8-6), Tormentor 259 (6-7), Imp. Golden Fern's Lad 2160 (8-4), Golden Fern 4711 (7-4), Ida's Stoke Pogis 15658 (7-4), Sultanne's Favorite 873 (9-0), Golden Lass 4th 2447 (8-0), Oonan 1485 (6-2), Sultana's Rosette 2881 (6-2), Bachelor of St. L. 4558 (6-1), Ida of St. L. 24990 (6-1), Baron's Sophie 17615 (2-5), Sophie's Tormentor 21883 (2-5), Hood Farm Pogis 40584 (5-0) and Oonan's Pogis 17165 (5-0) are the animals with more than four appearances on the sire's side of the pedigree or more than three on the dam's side. The number of appearances of these animals are chiefly of in-

terest in comparison with the animals which have several appearances in the pedigrees of the sires which lower the milk production and butter-fat percentage of their daughters as compared with the milk production and butter-fat percentage of their dams. The complete lists for these sires classified in the same way as the previous list is given in table 13.

TABLE 13.

Animals Repeated in Pedigrees of Sires which Decreased the Milk Production and Butter-Fat Percentage of their Daughters as Compared with the Milk Production and Butter-Fat Percentage of their Dams.

Sire's Side of Pedigree FIRST GENERATION Name and No.	Number of Appearances	Dam's Side of Pedigree FIRST GENERATION Name and No.	Number of Appearances
Hood Farm Pogis 9th 55552	3	Fontaine 8th 5608	1
Eminent 2d 2532	2	Mabel 35th 6311	1
Hood Farm Torono 60326	2	Gelatine 3d 114531	1
Gertie's Son 66463	2		
Mabel's Raleigh 3722	2		
Imp. Golden Fern's Lad 2160	1		
The Owl 2195	1		
Merry Maiden's Grandson 71003	1		
Harry Torment's Signal 39846	1		
Admiral Noel 53882	1		
Mabel's Poet 2964	1		
Caiest 2591	1		
SECOND GENERATION		SECOND GENERATION	
Stoke Pogis of Prospect 29121	4	Boyle 1559	2
Imp. Golden Fern's Lad 2160	3	Gen. Janeont 42212	2
Hood Farm Pogis 40684	3	Caiest 2591	1
Figgis 76106	3	Champion Flying Fox 2729	1
Eminent's Raleigh	3	Torono 25204	1
Gertie of Glynllyn 74474	3	Imp. Golden Fern's Lad 2160	1
Torono 25204	2	Gelatine 61404	1
Eminence 7124	2	Carnation's Fern's Lad 2826	1
Tormentor's Lass 59832	2	Mabel 23rd 3213	1
Oxford Lass 3582	2	Henry Hudson 27970	1
Champion Flying Fox 2729	2	Minute Gun 34776	1
Mabel Marcus 8611	2	Admiral Noel 53882	1
Mabel 35th 6311	1	Hood Farm Torono 60326	1
Ethleel 2d 32291	1	Commilla 79614	1
Marion 1699	1	Lord Harry 3445	1
Caumais Lad 2257	1	Hamley 2637	1
Caiest 2591	1	Lanison 15283	1
Merry Maiden's Grandson 71003	1	Melia Ann's Stoke Pogis 22042	1
Golden Fern 4711	1	Kate Gordon 8387	1
Boyle 1559	1		
Fontaine's King 2207	1		
Alicante 3880	1		
Merry Maiden's 3d Son 60516	1		
Fancy's Harry 9777	1		
St. Lambert Boy 17408	1		
Oonan 28th of Hood Farm 163228	1		
Croton Maid 4th 26729	1		
Landseer's Columbus 30839	1		
Matenee 73063	1		

THIRD GENERATION	
Golden Lad 1242	8
Boyle 1559	6
Eminent 2d 2532	5
Sophie's Tormentor 20883	5
Ida Marigold 32615	5
Imp. Golden Fern's Lad 2160	4
Sultana's Rosette 2881	4
Stoke Pogis 5th 5987	4
Tormentor 259	4
Oonan's Pogis 17165	3
Golden Fern 4711	3
Count Wolseley 928	3
Girletta 61472	3
Ramapose's Bachelor 25900	3
Birdsey Surprise 48326	3
Rill 6982	3
Kathlettas' Fancy 60738	3
Lord Harry 3445	2
Minute Gun 34776	2
Diploma's Grinella 145775	2
Marcus 2461	2
Mabel 31st 5324	2
Oonan's Tormentor 22280	2
Rhoda Hudson 48723	2
Oxford Primrose 2252	2
Addie P. 41428	2
Blue Belle 4307	2

THIRD GENERATION	
Golden Lad 1242	4
Sophie's Tormentor 20883	3
Tootsie 3214	2
Ida's Rioter of St. L. 13656	2
Lord Dartmouth 6302	2
Financial King 2624	2
Kindergarten's Duke 20065	2
Ninety-nine 94158	2
Moss Rose of Willow Farm 5194	2
Garfield of Woodstock 35621	2
Gertie of Glynllyn 74474	2

FOURTH GENERATION	
Golden Lad 1242	14
Tormentor 259	10
Sultanne's Favorite 873	9
Boyle 1559	8
Golden Lass 4th 2447	8
Imp. Golden Fern's Lad 2160	7
Tootsie 3214	6
Ida's Rioter of St. L. 13656	5
Eminence 7124	5
Tonan 1485	5
Arawana Marigold 9380	5
Ida's Stoke Pogis 13658	5
Bachelor of St. Lambert 4558	5
Baron's Sophie 17615	5
Golden Fern 4711	4
Diploma 16219	4
Sarabond 797	4
Stoke Pogis 1259	4
Rosette 4th 2128	4
Marjorain 3239	4
Young Fancy 97	4
Angela 1607	4
Sultanne 7	3
Canada's John Bull 8388	3
Brown Fern 2d 1944	3
Wolseley 401	3
Hope 1948	3
Lulu 5323	3
Pedro of the Valley 8750	3
Usilda's Pride 13921	3
Ida's Landseer 17745	3
Crocker 19563	3
Kathletta 19567	3
Flashy Jessie 2d 23332	3
Ramapose 24006	3

FOURTH GENERATION	
Golden Lad 1242	7
Bachelor of St. Lambert 4558	5
Eurotas 2454	4
Combination 4389	4
Diploma 16219	4
Golden Lass 4th 2447	4
Sultanne's Favorite 873	4
Tormentor 259	4
Boyle	3
Baron's Sophie 17615	3
Mermaid of St. Lambert 2d 39369	3
Nora's Hugo Pogis 26199	3
Garfield Stoke Pogis 26199	3

The animals appearing in table 13 which have more than four appearances on the sire's side or more than three appearances on the dam's side of the pedigree may be arranged in the same manner as for table 12. The names of the animals in *italics* also appear in the list of superior sires. *Golden Lad* 1242 (22-11), *Boyle* (15-6), *Imp. Golden Fern's Lad* 2160 (15-4), *Tormentor* 259 (14-4), *Golden Lass* 4th 2447 (8-4), *Sultanne's Favorite* 873 (9-4), *Golden Fern* 4711 (8-3), *Tootsie* 3214 (7-3), *Bachelor of St. L.* 4558 (5-5), Diploma 16219 (5-5), *Sophie's Tormentor* 20883 (5-4), Eminence 7124 (7-1), Eminent 2d 2532 (7-1), Ida's Rioter of St. L. 13656 (6-2), *Baron's Sophie* 17615 (5-3), Stoke Pogis 5th 5987 (6-0), *Sultana's Rosette* 2881 (5-1), Count Wolseley 928 (5-1), Combination 4389 (5-1), Ida Marigold 32615 (5-0), Stoke Pogis of Prospect 29121 (5-0), *Hood Farm Pogis* 40684 (5-0), *Ida's Stoke Pogis* 13658 (5-0), Arawana Marigold 9380 (5-0), Oonan 1485 (5-0), Eurotas 2454 (0-4), Lord Dartmouth 6302 (0-4), constitute the animals which appear in the pedigree of the sires whose progeny performance is poor.

The names in *italics* in the above group of animals make it clear that most of the sires whose progeny test shows them superior have ancestors in common with the sires whose progeny test show them inferior. This is especially true for the sires which appear a large number of times for either group. Examination of table 12 in conjunction with table 13 shows that no sires who increased the production of his daughters has ancestors which repeat four times on the male side or three times on the female side which do not also appear in the pedigrees of the inferior sires decreasing the production of both these items. A similar examination of this list of bulls extracted from table 13 shows that the only bull which does not appear at all in the pedigrees of the bulls which increased their daughters' production is Lord Dartmouth 6302 (0-4).

When cognizance is taken of the fact that the appearances of a bull in table 12 should be multiplied by 1.7 to make them comparable with table 13 as there are only 28 pedigrees in this table to 47 in table 13 it at once becomes clear that in the number of appearances of these bulls even though all the bulls which appear four times on the male side or 3 times on the female side in the first table also appear in the second pedi-

grees. Thus Ida's Stoke Pogis 15658, Golden Lad 1242, Golden Fern 4711, Sultana's Rosette 2881, Oonan 1485, Ida of St. Lambert 24990 and Oonan's Pogis 17165 appear more often in the pedigrees of the sires who increase the production of their progeny than they do in the pedigrees of the sires whose progeny performed poorly.

From this pedigree analysis certain conclusions may be drawn as to the value of pedigree study in determining the worth of a Jersey sire. It is clear that animals, like Golden Lad 1242, may occur in the pedigree of sires of inferior merit as well as in the pedigree of sires of real worth.

The instances of this are not rare for as may be seen from the two tables practically every animal which appears in the one group of the pedigrees also appears in the pedigrees of the other group. These facts make it clear that the only true test of an animal's worth is the performance of his progeny. It is also clear that the study of the pedigree as ordinarily made by the breeder has very little real significance. This performance test may as in this study be entirely devoid of any hypothesis or preconceived notion of inheritance or the worth of any individual animal.

SUMMARY

This paper has as its objective a "Progeny Performance" analysis of the American Jersey Registry of Merit Sires, to ascertain the nature of their transmitting qualities for milk production, butter-fat percentage and butter-fat, the whole to be put in concrete, easily understandable, numerical terms. For this purpose we define the sire which causes his daughters to be better producers, whether it be in quantity or quality of their milk, than their dams, as sires superior in their transmitting qualities, for either or both of these variables and the sires as inferior in their transmitting qualities for quantity or quality of milk when their daughters are poorer producers than their dams. The numerical measure for these transmitting qualities of a given sire is the difference between his daughters and their dam's milk production, butter-fat percentage and butter-fat as the case may be. The plus sign indicates the sire of superior transmitting qualities; the minus sign the sire of inferior trans-

mitting qualities. The numerical value of the difference denotes the extent to which a sire's transmitting qualities are superior or inferior.

Certain technical difficulties arise in the application of the test. The milk records are made at any age up to seventeen years old. Now it is known that age changes, change the milk production of a cow. It is necessary to eliminate these age variations before a comparison can be made between a daughter's milk production and her dam's milk production to obtain the sire's transmitting ability. These age variations in milk production and butter-fat percentage may be corrected for when the relation between age of the cow and these variables milk production and butter-fat percentage, are known. This correction has been applied to all these records of daughter-dam pairs before they were used in this study. The standard age chosen was eight years.

The quartile limits for the corrected milk production and butter-fat percentage were determined both for the daughters and for the dams that composed the daughter-dam pairs. These quartile limits are shown in table 2. This information showed the daughter's milk production to be the same as the dam's milk production within the limits of random sampling, the daughter's butter-fat percentage to be lower than the dam's by a slightly significant amount.

The probable errors of the sire's transmitting qualities (=Daughter's performance—Dam's performance) are derived from the standard deviations of the corrected milk production and butter-fat percentage. These probable errors are shown in table 3. The probable error for a single daughter-dam pair was so large that it was deemed advisable to limit this study to those sires which have two or more such pairs.

The quartile lines divide the population into four equal parts. These parts are designated A the highest, B the next highest, C the next lower and D the lowest. The relative milk production or butter-fat percentage of each daughter-dam pair has been determined in this manner. The position of the dam is placed first and the position of the daughter second. Thus a record AB for milk production states that the dam's milk production was above 10403 pounds, and the daughter's milk production between 9213 and 10780 pounds.

By the use of these methods three tables have been formed. The first table, No. 4, gives the necessary information to show what were the transmitting qualities of Jersey sires for milk production. The second table, No. 5, shows the information necessary to determine the transmitting qualities of Jersey sires for butter-fat percentage. The third table, No. 6, shows the transmitting qualities for these same Jersey sires for net butter-fat.

There are 224 Jersey Registry of Merit sires which meet the requirements of this performance test for their transmitting qualities in milk production. One hundred and five of these sires or less than one-half raise the milk production of their daughters over that of the dams of these daughters. The largest number of daughter-dam pairs is 39 for the sire Hood Farm Pogis 9th, 55552. Of those sires which have a large number of pairs, Hood Farm Torono 60326 with 34 pairs stands first in his transmitting qualities raising the milk production of his daughters on the average 2620.1 pounds. The relative milk productions of his daughter-dam pairs on a percentage basis are 26 AA+3AB+9BA+3BC+32CA+9CB+9DA+3DB+3DC. Described in words, this bull was bred to 26 per cent of the highest group of milking cows and produced 26 per cent of the highest group of milking daughters; bred to 3 per cent of the highest group of milking cows he produced 3 per cent of the second highest group of daughters, etc.

The next sire with a good number of daughters was Spermfield Owl. This bull with 26 daughter-dam pairs raised the milk production of these daughters on the average 1695.7 pounds. The relative milk productions of his daughter-dam pairs on a percentage basis are 12AA+4AB+4AC+23BA+12BB+4BC +8CA+8CB+4CD+12DA+4DB+8DD.

Among the other sires standing well up in the lists might be mentioned Queen's Raleigh, 88232; Sans Aloi 81012; Temisia's Interested Prince 71698; The Plymouth Lad 89792; and Chief Engineer 47148.

Two hundred and twenty-five sires are included in the table 5 giving the sires which met the requirements of the daughter-dam performance test for transmitting qualities of butter-fat percentage. Out of this number 101 sires raised the butter-fat percentage of their daughter's milk as compared with the butter-fat percentage of the dams of these daughters.

The leading sire in this butter-fat percentage performance test was Clear Brook Chief 74685 raising his daughter on the average 1.338 per cent of butter-fat. This sire had two daughter-dam pairs. The dams were both in the lowest group for butter-fat percentage (class D) and this sire raised his daughter from these dams to the highest group (Class A).

Among the sires with a fair number of daughter-dam pairs which raised the butter-fat percentage to a marked degree might be mentioned Irene's King Pogis 73182; Merry Maiden's Grandson 71003; Pogis 75th of Hood Farm 94501; Jacoba's Emanon 84177; and Golden Fern's Son 78687.

Hood Farm Pogis 9th leads in number of daughter-dam pairs with 42. This bull raised the butter-fat percentage of his daughter on the average of 0.243 per cent over the butter-fat percentage of the dams of their daughters.

The sires mentioned as superior in the milk transmitting ability, Hood Farm Torono and Spermfield Owl, do not check up so well in their ability to transmit high butter-fat percentage. Hood Farm Torono caused his daughter on the average to be 0.225 per cent of butter-fat below what the dams of these daughters produced. Spermfield Owl only raised his daughters on the average 0.027 per cent of butter-fat over what the dams of these daughters produced.

There are 224 sires of known transmitting ability for net butter-fat given in table 6. Of this number only 99 sires raise the butter-fat production of their daughters over that of their dams. The sires which raised the production of their daughters' butter-fat most were Sans Aloi 81012, Signal's Successor 72758, and Golden Glow's Chief 61460. The sires which made the deepest impress on the breed by raising the butter-fat of the largest number of daughters over that of their dams was Hood Farm Torono with 34 pairs and an average increase for each daughter of 121.51 pounds of butter-fat. The next bull, Spermfield Owl, with 26 pairs raised the butter-fat production 97.71 pounds on the average for each of his daughters. Some of the bulls lowering the production of their daughters markly were Gertie's Son of Washington 83799, Hood Farm S. Tormentor 96311, and Oxford Lad's Owl 75599.

The information summarized above was arranged in table 7 to reveal the transmitting qualities for milk production, but-

ter-fat percentage and butter-fat of Jersey sires to their sons. There were in this table 159 sires which had sons whose progeny performance was known. Of this number 69 or significantly less than half had sons who raised the butter-fat production of their daughters over that of their dams. Among these sires who had sons of merit Signal's Crown Prince 61621 and Chief Engineer 47148 are the leaders. Among those sires whose sons lowered the butter-fat productions of their daughters may be mentioned Merry Maiden's Grandson 91003 and Ethleel 2d's Jubilee 18249.

The sires of superior merit are defined as those which raise the milk production and butter-fat percentage of their daughters as compared with that of their dams. The inferior sires are defined as those sires who lower the milk production and butter-fat percentage of their daughters as compared with the same variables in their dams. The superior sires so defined are arranged in table 8 by the amount of butter-fat that they increase the production of their daughters over that of their dams. The inferior sires are classified in table 9 according to the amount of butter-fat that they decrease the production of their daughters in comparison with that of their dams. These two groups of sires are subjected to four generation pedigree analysis to determine their inbreeding and relationship, the amount of Island and American stock, "males and females" and "on the sire's side of the pedigree and on the dam's side of the pedigree," and the individual animals most frequently repeated into two groups of pedigrees.

There are 28 sires in the group of sires superior in their transmitting qualities for milk production and butter-fat percentage. In the group of sires inferior in their transmitting ability for these two characters there are 47 sires, a ratio of 1 to 1.7. Such a difference speaks for itself. It emphasizes with startling clearness the need of exact knowledge of the transmitting qualities of bulls to be bred as sires and of the necessity for exact knowledge of the inheritance of milk production and butter-fat percentage.

The inbreeding coefficients show that the sires of superior merit have 7.08 per cent of the greatest possible inbreeding up to the fifth generation. The inferior sires are inbred 9.65 per cent of the greatest possible amount (continued brother and

sister mating). The group of sires poorer in their transmitting qualities are consequently more inbred than the group of sires with superior transmitting qualities.

The analysis of the pedigrees for the amount of relationship that may exist between the sire and dam of the individual bulls in the superior group and in the inferior group shows that there is little or no difference in the amount of this relationship within the two groups.

The resolution of the four generation pedigrees into the Island bred Jerseys and by difference into the American bred Jerseys showed the mean number of island males in the pedigrees of the superior sires' group to be 8.07 and the mean number of females 7.79. The mean number of island bred males in the inferior sires' group were shown to be 6.94 and the mean number of females 6.55. The group of sires which increased the production of their daughters over that of their dams had, consequently, more island bred stock in their pedigrees. The females in each group of the pedigrees had a less proportion of island bred individuals than the males had in each of the groups.

This same information on island bred animals is revealed when classified as to whether the animals occur on the sire's or dam's side of the pedigree that the superior sires have by a small percentage more island bred animals in the sire's side of their pedigree than do the inferior sires and that the superior sires have a larger number, probably significantly larger number of island ancestors in the female side of the pedigree than do the inferior sires. The figures are 8.82 to 8.19 and 7.04 to 5.30. The number of ancestors of island breeding on the sire's side of the pedigree is in both cases larger than the number of island bred ancestors on the dam's side of the pedigrees.

These conclusions are further substantiated by a study of the proportion of island ancestors in the great-great-grand parents of these two groups of sires.

Study of the pedigrees of these two groups of sires discloses the fact that all the animals which appeared in the pedigrees of the superior sires on the male side of the pedigrees more than four times or on the female side of the pedigree more than three times also had appearances in the pedigrees of the sires inferior in their transmitting qualities. This fact

alone makes it clear that the appearance of certain famous animals in a pedigree of a given bull is no guarantee of that particular bull's worth.

SPECIAL STATEMENT

Because of the expense of printing, the publication of the literature list and the raw data on which the text tables are based is reserved for a separate smaller edition. This supplement may be obtained by application to Director Chas. D. Woods, Maine Agricultural Experiment Station, Orono, Maine.